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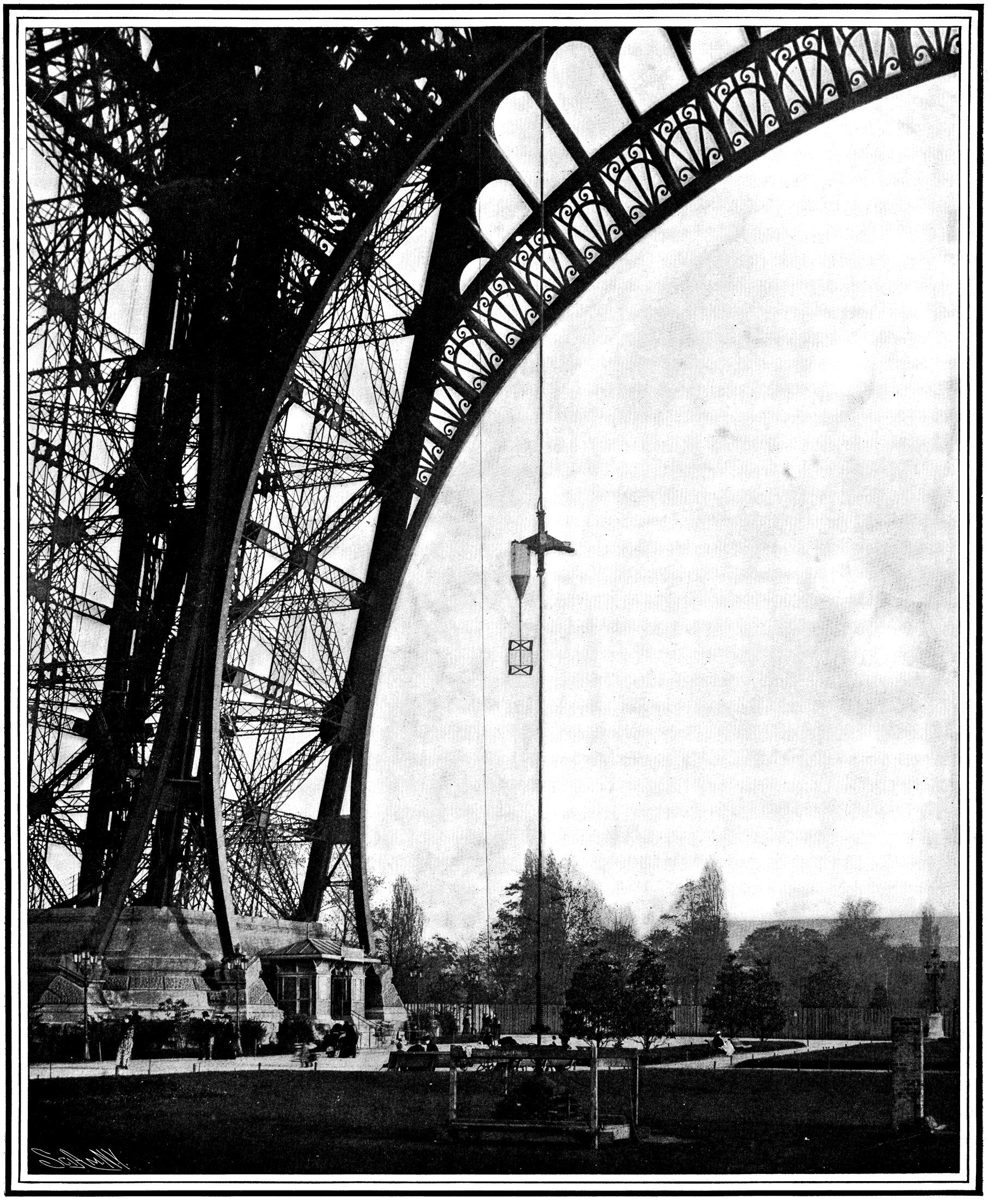
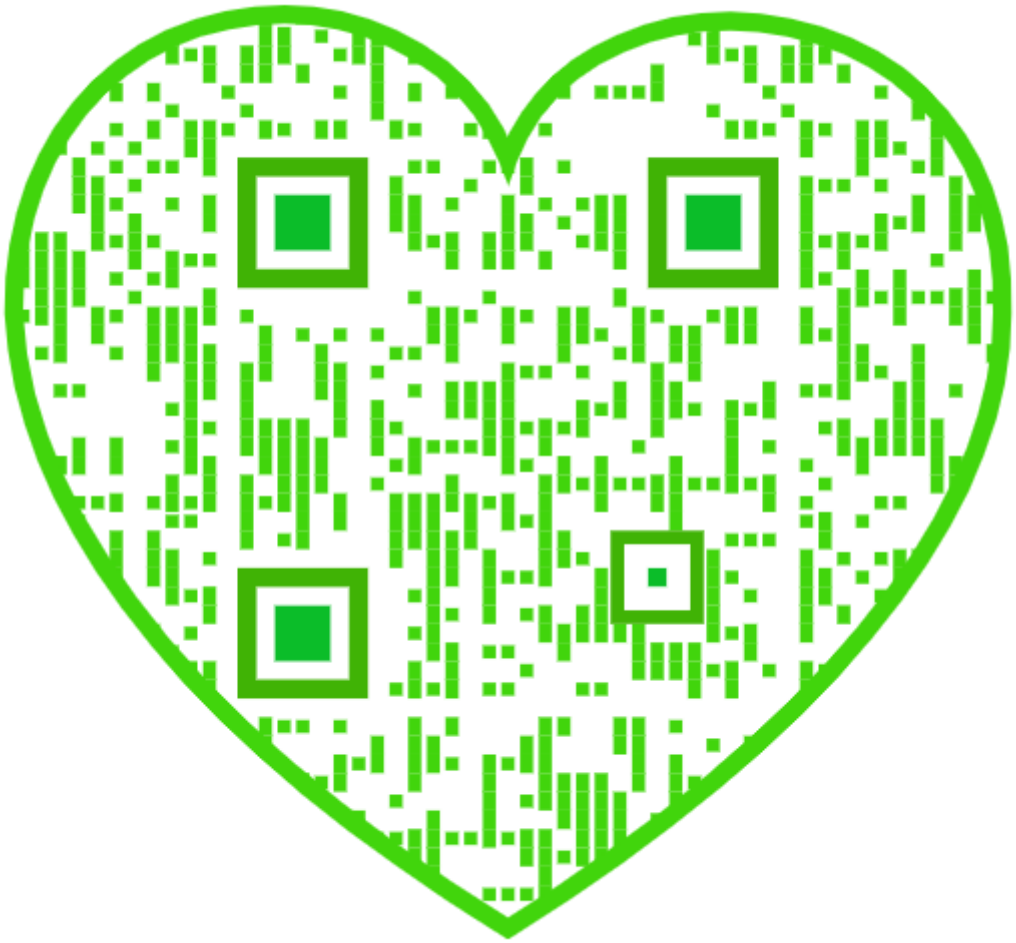


THE BASE OF THE EIFFEL TOWER, SHOWING THE APPARATUS FOR MEASURING THE PRESSURE OF WIND.—[See page 230.]



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NEW YORK, SATURDAY, MARCH 19, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE COMPLETION OF THE NORTH RIVER TUNNEL.

March 11, 1904, must ever be memorable in the history of this city as marking the completion of the first tunnel to give access from Manhattan to the neighboring shores of New Jersey. The event was signalized by the passage beneath the North River, dry-shod, of President William G. McAdoo, of the New York & New Jersey Railroad Company, and a party of invited guests. Although it will take another year to clean up the work, build the approaches and put in the finishing touches, the long-looked-for and much-delayed North River Tunnel is at last an established fact. Great credit is due Engineer Charles M. Jacob and his staff for the way in which a difficult and discredited work has been brought to an unusually successful termination, the junction being effected with mathematic exactness.

With the breaking away by the workmen's tools of the last screen of material, there is marked the practical consummation of an engineering work which has been in progress intermittently for about a quarter of a century. The scheme was originally planned in 1874. The first English company that took hold of the project had carried the tunnel about 2,000 feet beneath the bed of the North River when they met their first serious difficulty in a blowout, which resulted in the death of twenty men who were working at the heading. Three years after this the company failed; and after a period of seven years, during which nothing was done upon the scheme, another company took hold of the work, only to meet with failure. The present New York and New Jersey Company took up the work in 1901, when 3,895 feet of tunnel had been completed from the New Jersey side; and in spite of some very complicated problems presented by a ledge of rock which was encountered not far from the New York side, and a blowout which occurred at this point and occasioned considerable delay, the work has been prosecuted without interruption. The second tunnel, which parallels the one that has just been completed and lies a little to the south of it, is being excavated with a more modern and greatly improved shield, which is enabling the work to be prosecuted with greater rapidity. Already it has been pushed forward about 1,500 feet beneath the river, and the rate of progress per day is steadily increasing as the work is carried forward. The indications are that some time in the spring or early summer of 1905, it will be possible to run cars between Manhattan and New Jersey.

In this connection mention should be made of the fact that the contract for the excavation of the Pennsylvania Railroad tunnel beneath the North River has recently been let to the O'Rourke Engineering and Construction Company and that for the tunnels beneath the East River to S. Pearson & Son, of London. The contract provides for the completion of the tunnels in two years, with the stipulation that the time limit may be modified if any labor troubles occur during the progress of the work.

DIRECT-CURRENT TRACTION ON THE NEW YORK CENTRAL.

Unquestionably the most important step that has yet been taken in the application of electric traction to steam railroads was the recent closing of the important contract of the New York Central Railroad for the first large installment of its electrical equipment. The company have recognized for several years that the time was approaching when this important change would have to be seriously considered; but it was not until two years ago, when the Park Avenue tunnel disaster occurred, that the necessity for immediately taking this work in hand became apparent. It is well understood by those who are familiar with the state of the art of electrical traction, that, because of the transition stage through which it is passing, the present time is somewhat inopportune for undertaking so costly a work, and one upon which the future extensions of electrical equipment must be based. We refer to the development of alternating-current electric traction, which has been making of late such rapid strides, particularly in the hands of European engineers. Within a year or two the new systems that have been installed or are now being built, will have given sufficient data to determine the strong and weak points of the alternating current when used in this class of work, and the alternating-current motor will have settled down to something like its best and permanent form. It was urgent, however, that the change of motive power should be made at once, and therefore a choice had to be made between the well-tried direct-current system, as used almost exclusively on American electric roads, and the new alternating-current system, which undoubtedly gives promise of being in some respects superior to the older method. In the course of a recent interview of our Editor with one of the officials of the New York Central Railroad Company, the considerations which determined the decision in favor of the direct current were outlined as follows:

The first consideration was the fact that the New York Central suburban system must be considered as forming a section of the general suburban transit facilities of Greater New York, and that any radical change in its motive power must be considered with a view to possibilities of interchange of cars with intersecting or contiguous lines. Thus, the question of an interchange of the company's trains with those of the subway system has been seriously suggested from time to time, and as the subway is being equipped with the direct current, the adoption of the alternating-current system would have shut it out from any such interchange as might have seemed desirable. Then, again, there was the necessity for very prompt action in abolishing steam from the Park Avenue tunnel, a point on which the railroad has committed itself in distinct pledges to the New York public. At the same time, the decision to use the direct current for the first installment is not intended to control the action of the company with regard to any further extensions that may be made. Any other division of the line will be judged by the local conditions. The division of the New York Central lines affected by the present contracts will include the terminal at 42d Street, and the Hudson River and Harlem lines as far as Croton and White Plains. These two points are considered to be the limits of the suburban traffic, and on these divisions the suburban trains will be operated by motor cars on the multiple unit system, as used on the elevated railroads. Through trains will be brought into and out of New York by heavy electric locomotives, each weighing 85 tons, and capable of pulling a 500-ton train on the level at a constant speed of 75 miles an hour. If in the future the company should determine to electrify another stretch of the road, say, from Croton to Albany or from White Plains to Pittsfield, with the alternating-current system, it would merely be necessary to change from a direct current to an alternating current at these points.

There were other minor considerations which led to the choice of the direct current, but the most important consideration was the fact that the electrical apparatus and equipment when it came to be discarded, would find a more ready sale if it were of the direct than if it were of the alternating-current type. It was considered that because alternating-current traction is comparatively in its infancy, the improvements that would be made, and made probably in rapid succession, would soon render the present type of motor more or less obsolete; and when the improved apparatus and equipment were put in, it would be far more difficult to find a sale for discarded alternating-current electrical equipment than it would if it were of the direct-current type, the latter having settled down to certain standard forms that always have a good second-hand market value.

THE MOTIVE POWER FOR HIGH-PRESSURE FIRE SERVICE.

Stirred by the succession of great conflagrations which culminated with the destruction by fire of the greater part of the business section of Baltimore, New York has at last awakened to its own danger and Mayor McClellan has taken action which promises speedily to provide both Manhattan and Brooklyn with a system of high-pressure salt-water fire pipes such as were recommended years ago by former Chief Bonner of the fire department and by the New York Board of Fire Underwriters.

Of the general merits of such a system little need be said. The only criticism offered at the public meeting before the Mayor was that salt water was liable to do more damage to goods than would fresh water, and former Mayor Schieren of Brooklyn suggested therefore that the proposed new system draw its water supply from the present sources of fresh water. Part of this argument was offset by the admitted superiority of salt water as a fire extinguisher, and the rest was disposed of by the fact that neither Manhattan nor Brooklyn has a drop of fresh water to spare for any purpose.

The necessity for a high-pressure system of pipes, separate and distinct from the ordinary distributing system, was acknowledged by all the speakers. That such a system is not only a crying necessity for the whole of Manhattan below 42d Street and for the river front and drygoods district of Brooklyn in order to avert fire danger, but that its installation would be an actual source of economy, was demonstrated.

In Philadelphia, where a similar system has just been completed, the fire premiums on $200,000,000 worth of risk have already been reduced 15 cents per $100 and a further reduction of 10 cents is promised. This reduction alone means a return of nearly 10 per cent per annum on the whole cost of the plant, leaving out of consideration the saving made possible in the general operation of the fire department.

The power plant at Philadelphia is equal in effect to forty fire engines. Where its six-hose hydrants stand, there is no need to maintain engines. Only hose and hose-carriages are needed. In New York a question has been raised as to the character of engines which should be used for driving the fire pumps. Philadelphia settled that question after a careful inquiry by adopting a battery of Westinghouse gas engines.

Three power systems would naturally suggest themselves, viz., steam, gas, and electricity. If the power stations were to be operated continuously or for any considerable portion of each day, there can be little doubt that steam would be the choice. But a fire-fighting station only operates when there are fires in the district. Steam plants must have boilers as well as engines, and for fire purposes a full head of steam must be kept up at all times. This means expense in attendance, fuel, and depreciation of boilers.

The Philadelphia danger zone is of like character to those in New York. It is estimated there that the pumping station will be called upon to do about 10 hours' work a month.

The first saving effected by the substitution of gas engines or electric motors for steam, is the elimination of the boilers and the space they occupy. This means much in the cost of land and buildings alone. Second is the saving in fuel and attendance. In Philadelphia, where eight 280-horse-power Westinghouse gas engines are installed, the engines made the following comparative figures:

	Steam Engines.	Gas Engines.
Number of engines.....	3	8
Number of boilers.....	8	
Cost of engines.....	$140,000	$150,000
Pumping capacity, 24 hours, gals. 15,000,000		16,000,000
Wages per month.....	$650	$450
Cost of gas per month..		$392
Cost of coal per month..	$500	
Oil, waste, etc.....	$48	$48
Repairs	$85	$85
Total cost per month...	$1,283	$975

The saving in space and attendance would be common to both the gas-engine plant and an electric-motor plant. Each would be operated by one man to a station, and there is no question but that each could be so connected with its respective supply of gas or electricity as to do away with any practical danger of interruption through accidents to gas plants or central stations.

The use of electric motors would admit of the adoption of centrifugal pumps, which have some advantages. Gas engines cost about $40 a horse-power. Electric motors would cost considerably less. It is interesting, therefore, to consider the comparative merits of the two systems with the cost of installing and operating them.

Each stands ready to operate at full power the moment it is called upon, while consuming nothing while it waits.

Electric motors themselves would not cost more than about one-half as much as gas engines of equivalent power. This would seem at first to be a strong argument in their favor, but upon further consideration much of this advantage disappears. When switchboards have been added and direct connections made with two or more independent sources of power, the items of cost will mount pretty near to those for the gas-engine plant.

Cost of operation furnishes a further argument in favor of the gas engine. The Westinghouse gas engine is guaranteed to produce a brake horse-power with the consumption of 11,500 British thermal units. Street gas in New York gives from 650 B. T. U. upward per cubic foot. On this basis 17½ feet per hour would furnish 1 horse-power. In a recent 24-hour test run in Philadelphia with one of the engines, the con-

sumption of gas was 20.45 cubic feet per horse-power hour. Gas costs $1 a thousand feet or less. It is proposed in this city to install in each pumping station three 1,500-horse-power units, or 4,500 horse-power, and to erect three or more stations in Manhattan and two perhaps in Brooklyn. Gas, on a basis of 20 cubic feet per horse-power hour and $1 per thousand, would cost 2 cents a horse-power hour, or $90 an hour for each station. Ten hours a month would make the fuel cost $900 per station.

The lowest price at which electric current is sold in this city is 5 cents a kilowatt. At this rate, and allowing nothing for loss in converting the current into power at the motor, the supply would cost $1,687.50 for 10 hours' use per month per station, or nearly double the cost of gas. With five stations of the size mentioned, the difference in cost would amount in a year to $46,050.

Gas engines of 1,500 horse-power are already built and in successful use, and their adaptability to fire service has been demonstrated. Electric motors of that size would be an experiment, although they could undoubtedly be successfully built and operated.

One other matter deserves consideration. This is the source of supply. No one questions the ability of the gas companies to furnish all the fuel that might be required, even if the whole power of every pumping station were required for many hours at a time. Gas can be had and is stored in vast quantities.

Electrical conditions are different. It is a grave question whether any producer of electric current would be willing to have the fire pumping stations as customers at any price as a commercial proposition. Some of them might be willing to supply the current from motives of civic patriotism.

The proposed pumping stations would be the worst kind of customers from the commercial point of view. They would ordinarily take no current, and, when they did demand power, would require it in enormous quantities. The demand would be as likely to occur during the hours when the ordinary drafts upon the power houses were at the peak as at any other times.

The report of the State Railroad Commission, made recently upon the condition of the street and elevated railroads in this city, showed clearly that there exists a great lack of electric power for ordinary purposes, especially in Brooklyn, and that no surplus of power is likely to exist for a long time to come. A sudden demand for 4,500 horse-power—just enough to operate one of the proposed stations—occurring in a busy hour would be a serious thing, and a demand for power to operate two or three such stations would at times tax the abilities of a combination of several of our largest stations.

THE BRITISH NAVAL PROGRAMME FOR 1904.

BY OUR LONDON CORRESPONDENT.

The British naval programme for 1904 is an expensive and elaborate one, the estimates for the ensuing year aggregating $184,445,000. This sum represents an increase of $12,160,000 upon the estimates for 1903, and is the largest sum ever voted by the British government for naval purposes for one year.

The sum to be expended upon the construction of new vessels is $58,370,880, which is also an increase of $7,588,730 upon that for 1903. Of this sum, however, $5,000,000 will be devoted to the completion of the purchase for $9,375,000 of the two vessels "Constitucion" and "Libertad" which were built for the Chilian government and which were recently secured by the British Admiralty.

One result of their purchase has been the modification of the shipbuilding programme so far as concerns the construction of battleships. Only two battleships, instead of three, are authorized for the ensuing year. The composition of the new programme is as follows: First-class battleships, 2; armored cruisers, 4; destroyers, 14; submarines, 10; making a total of 30 vessels to be added to the fleet.

During the past twelve months, from April 1, 1903, to March 31 of this year, the British navy has been augmented by 40 ships composed as follows: Battleships, 6; armored cruisers, 9; second-class cruisers, 1; sloops, 2; submarines, 3; destroyers, 11; torpedo boats, 8.

By April 1 of this year the following ships will be in course of construction: Battleships, 8; armored cruisers, 13; second-class cruisers, 1; third-class cruisers, 4; scouts, 8; destroyers, 23; submarines, 11; river gunboats, 6. Total, 69 vessels.

During the twelve months from April 1, 1904, to March 31, 1905, which is the official year of the British government, 32 of these vessels will have been completed and passed into the navy. This addition will be composed of: Battleships, 3; armored cruisers, 5; second-class cruisers, 1; third-class cruisers, 4; destroyers, 8; submarines, 10; river gunboats, 1.

In the two battleships authorized in the current programme, the Admiralty propose to introduce a new class of vessel to be known as the "Lord Nelson" class. The heaviest battleships at present in the British navy are those known as the "King Edward VII." class, of 16,350 tons, and approximate the "Connecticut" class at present being built for our own navy. Mr. Philip Watts, the British naval designer and director, however, has a firm confidence in the heavy battleships, and these new ships will surpass the "King Edward VII." class. Although the tonnage, and in fact any particulars concerning this new type of battleship are being withheld from publication, I am in a position to state that they will approach the 18,000-ton vessels which were described some little while ago in the SCIENTIFIC AMERICAN. Their armament will be particularly formidable, especially so far as concerns the secondary class. They will each carry eight 9.2-inch guns in addition to the four 12-inch weapons, with ten 6-inch quick-firers in the central battery. The protective armor will resemble that of the "King Edward VII." class, only it will be commensurate with the larger dimensions of the new ships. Each vessel will cost $8,000,000.

During the past year the construction of the eight vessels constituting the authorized number for the "King Edward VII." class has been hurried forward. This course has been decided upon so that the Admiralty may have a homogeneous squadron composed of boats of the same design, speed, etc., since experience has shown that four sister ships form a unit possessed of great tactical and administrative convenience. The vessels in this squadron will be divided into two divisions of four vessels each. One very prominent feature of the British naval department is the celerity with which the work of construction is undertaken in both the government and private dockyards. During the past twelve months the government dockyards have carried out their work so efficiently and expeditiously that the construction programme of last year had to be accelerated in order to keep the yards sufficiently provided with work. The armored cruisers which are to be laid down this year will be of the "Duke of Edinburgh" type, armed with six 9.2-inch guns, and ten 6-inch guns, with a speed of 22¼ knots.

Special attention is being devoted to the construction and equipment of the fleet with efficient submarines. The naval department is convinced that this type of vessel has a useful sphere of action. Prolonged experiments have taken place during the past twelve months with the submarines already in commission. The ten submarines projected in the current programme are to be built upon the designs formulated as the result of the experiments upon the designs prepared by Messrs. Vickers, Sons & Maxim, Limited, the constructors of the present submarines.

The construction of the destroyers is being delayed somewhat, as the Admiralty desire to prove the efficiency of the steam-turbine-propelled ship more completely, before they commit themselves definitely to any system of propulsion for these craft. The various tests with the "Velox" and "Eden," both of which are fitted with Parsons turbines, have not yet been carried out. Furthermore, there are two vessels in process of construction at Messrs. Palmer's Yarrow-on-Tyne shipyards, which are equipped with inclosed engines. Both of these systems of propulsion promise well, so that the Admiralty have decided to await events before deciding the question.

During the coming year the personnel of the navy will have to be augmented by 4,000 men to man the new ships, bringing the actual fighting strength up to 131,100 men. The naval reserve is being considerably strengthened by the establishment of numerous centers at various points round the coast, obsolete third-class cruisers being depositioned to serve as drill ships.

The present vessels in the fleet are also being extensively overhauled and modernized in accordance with present requirements as rapidly as possible. These ships are being practically reconstructed and provided with as formidable a modern armament as their capacities warrant.

During the past year experiments have been conducted incessantly with oil fuel. Progress has been somewhat slowly, but has been exceedingly sure. There are innumerable difficulties at present to be overcome if oil fuel is to prove possible, but these problems are being gradually surmounted. The British naval department is sanguine that oil fuel is destined to play a very important part in naval affairs. Simultaneously with these experiments the question of the storage of this fuel is being closely studied and developed. The experience gained in this direction with the battleships "Mars" and "Hannibal" with their cylindrical boilers has been utilized in connection with the Belleville boilers of the "Bedford."

At the same time the policy of composing the various squadrons into homogeneous divisions of battleships is being zealously pursued. This is particularly the case concerning the Channel, Mediterranean, and China fleets. It is recognized as imperative, if a squadron is to prove efficient, that all the ships should be standardized as regards their speed, etc.

SCIENCE NOTES.

Comparing the values found for the heat of combustion of compounds of the fatty series with the figures for the heat of combustion of the cyclic compounds of the same molecular weight as the former, P. Zuboff, in a paper recently read before the Russian Physico-Chemical Society, arrives at the conclusion that the heats of combustion of the bodies of the fatty series, though being little different from those of the corresponding cyclic compounds, are nevertheless apparently somewhat higher than the latter. Thence it is inferred that the compounds with open chains possess a somewhat higher store of energy than the corresponding body consisting of a closed group of atoms.

Prof. Lugeon of the University of Lausanne has been studying the population of the valley of the Rhone between Martigny and the Rhone glacier. The statistics show that the right bank of the river between these points has a population of 34,000, while only 20,000 persons live along the left bank. He has found that along a part of the river banks which present exactly the same topographic conditions, the side which is most exposed to the sun has from four to five times as many inhabitants as the other bank, which is in the shadow of the mountains that ward off most of the direct rays of the sun. With one or two exceptions, all the villages have been built on the bank which is most fully exposed to the sun's rays.

At a recent meeting of the German Physical Society, Berlin, Herr Fr. Hensler read an interesting paper on the magnetical properties of manganese alloys. Whereas both pure manganese and manganese copper are known to be quite non-magnetic, the author has found that certain other manganese alloys are highly magnetizable even if copper or any other non-magnetical metals be added. The following list of metals and metalloids thus yielding more or less strongly magnetizable manganese alloys, free from iron, is given: Tin, aluminium, arsenic, antimonium, bismuth, boron. The most interesting results are derived from an investigation of manganese-aluminium-copper alloys, it being shown that keeping the latter for some time at a temperature of 110 deg. will reduce them to a state of stable equilibrium, corresponding with the maximum susceptibility. It may further be inferred that for equal percentages of manganese, the susceptibility will increase, as the percentage of aluminium is increased, until a maximum is reached, corresponding with equal atomic percentages of both metals. It is an interesting fact that, according to Wiedemann, Quincke and Du Bois' researches, aqueous solutions of manganese salts should exhibit magnetical susceptibilities somewhat higher than those of the corresponding ferric salts. As both the salts and certain alloys of manganese, which itself is not at all ferro-magnetic, thus show strongly ferro-magnetic properties, the author compares these alloys with a salt solution where copper would play the part of solvent, the above combination of atomically equal quantities of manganese and aluminium that of the solved salt. The transition points beyond which the alloys become non-magnetical are relatively low; for increasing percentages of manganese and aluminium they are found to rise. A. G.

M. E. Weinland has been making a series of researches to show why the digestive secretions do not attack the body of different living organisms. The organs which carry on digestion are charged with ferments which are powerful in attacking and dissolving the aliments which are introduced, but nevertheless they have no action upon the surface of these organs or upon the parasites which often lodge there. The reason for this has not been clear. In 1891, J. Frenzel gave the opinion that the parasites were protected by an anti-ferment which they secreted, and this could account for the fact that tape-worms, for instance, could take up their lodging in such organs. M. Weinland made some experiments which are of interest in this line of ideas. He took a certain quantity of fibrin and placed it in a pepsin solution in order to dissolve it, at the same time adding a small quantity of liquid obtained from the tape-worm (tænia). He found that in this case no digestion of the fibrin occurred, even though it was left in contact for an indefinite period, but otherwise it would be dissolved in a few hours. He thus considers that it is not the living tissues themselves which resist the action of the digestive liquids, but the secretions with which they are impregnated. The anti-ferment which he succeeds in extracting is very powerful in its action, and it keeps its properties for many months; it loses them by boiling, however. A temperature of 60 deg. C. for 10 minutes has but little effect, but at 80 deg. the activity is lessened. The active principle can be precipitated from the juice of the tænia by alcohol. Although it opposes the action of pepsin, a ferment and anti-ferment can be put in presence without destroying each other. The latter seems to exert only an opposing, and not a destructive action on the ferments, and when removed, the ferments commence to act as usual.

A DOUBLE-DECK CAR FOR RAPID TRANSIT.

Although the double-deck car is practically unknown in this country, it is very extensively used in Europe. In a recent examination of the question of double-deck cars made for the Merchants' Association of New York, by John P. Fox, it was stated that of the 6,660 electrical cars of Great Britain and Ireland, ninety per cent are double-deck and ten per cent single-deck, while of the 3,517 new cars in cities having a hundred or more cars in use, ninety-four per cent are double-deck. The report of Mr. Fox was made after he had carried out an exhaustive investigation of the subject during a visit to Great Britain and the European cities where the double-deck car is most extensively used, and it contains expressions of opinion from managers and superintendents of the various traction companies in Europe, as to the relative advantages of cars of the single and of the double-deck type. According to the statement of the General Manager of the Liverpool Corporation Tramways, it was thought desirable, when electric traction was introduced in Liverpool in 1888, to follow the American practice of using single-deck cars. Subsequently, on introducing double-deck cars the average time consumed per passenger in getting on and off worked out at 1.9 seconds; whereas in a large American city, where the operation of the cars is similar to that in Liverpool, the length of stop per passenger averaged 2.8 seconds on an open, twelve-seated car.

As showing the great increase in capacity secured by double-decking, it was mentioned in the report that some of the Liverpool single-deck American cars had stairs and an upper deck added, and were used on trial before the double-deck car was adopted as the exclusive type for service. These cars were used on Saturdays, Sundays, and holidays, and at other times when cars of large accommodation would be required. The seating capacity was increased from forty to one hundred by the addition of sixty seats on the upper deck. The total weight of the car was only 31,360 pounds, and the two 35-horse-power motors already installed on the cars proved sufficient for the work. The largest closed cars in New York are the convertible Third Avenue cars with cross seats, which are about the same length as the Liverpool converted American car; but they weigh 3,600 pounds more, and seat only forty-eight per cent as many passengers.

As our readers are aware, the Scientific American has for several years advocated the introduction of the double-deck car as one of the most efficient means for reducing congestion of surface railway travel in New York city. We had no idea, however, that the facts in favor of this type were as convincing as the Merchants' Association report has shown them to be; and we have yet to see any good argument advanced against the introduction of the type upon New York lines, or at least upon the Broadway line, the most congested of them all. The elevated railroad structure at the Thirty-third Street crossing might have to be raised slightly to provide sufficient clearance; but this could be done without any interruption of the traffic.

Width over all, 8 feet 10 inches. Height from top of rail to top of roof, 15 feet. Length over all, 53 feet 2 inches.

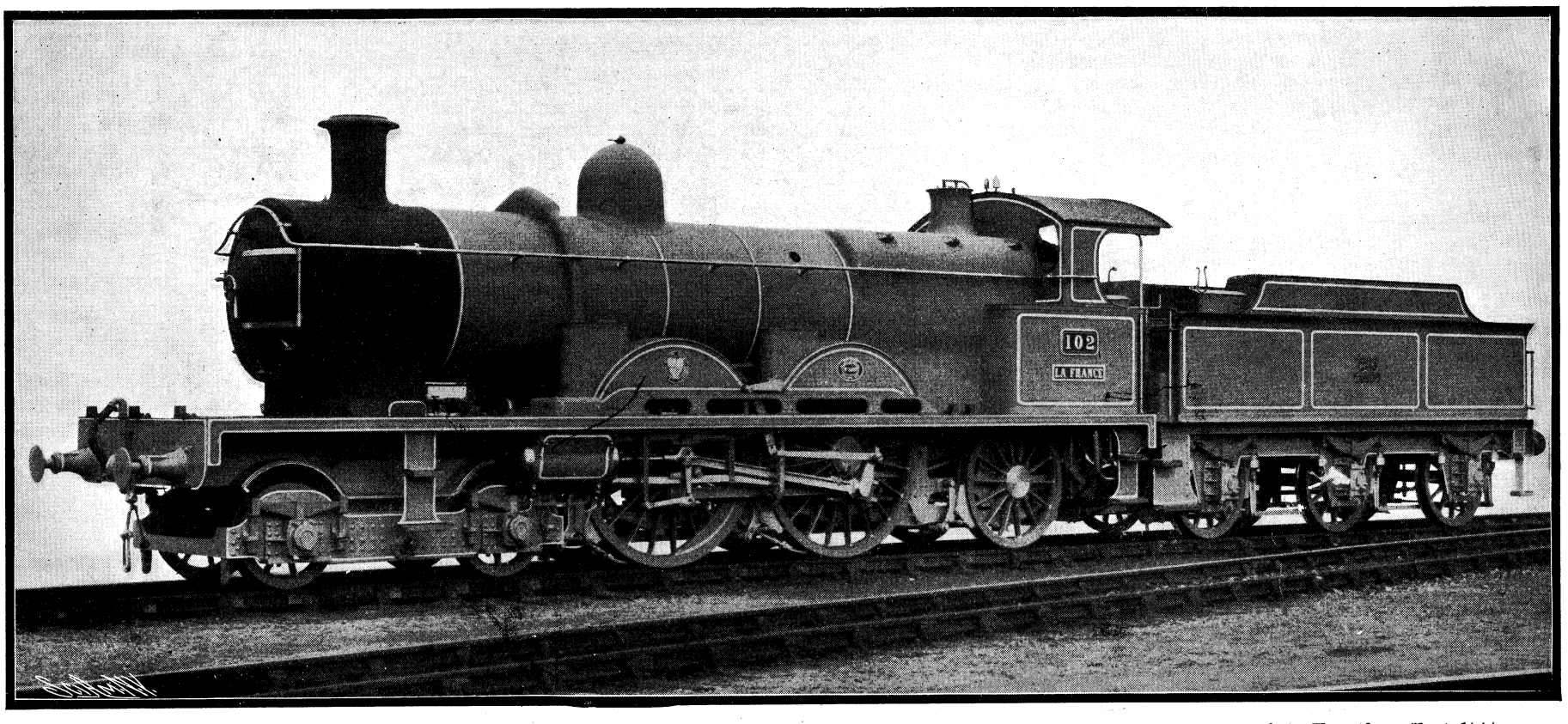
INTERIOR VIEW OF A DOUBLE-DECK CAR.

The double-deck car of which we herewith present an interior view was designed by James L. Getaz, Knoxville, Tenn., and is presented as being an interesting study of this problem. The car, as shown, is of larger capacity than would be used within the interior lines of city traffic, being more adapted for interurban service. It has a width over all of 8 feet 10 inches, a height from the top of the rail to the roof of the car of 15 feet. The length over all is 53 feet 2 inches. The car is vestibuled, and an entirely separate cab is provided at the front end for the motorman. To keep down the height of the car and provide good head room on both decks, the floor of the lower deck is lowered between the two trucks, access to this lower central portion being had by a couple of steps at each end. Access to the upper deck is by way of two stairways as shown, one on each side of the car, and the movement of passengers is facilitated by arranging the seats on the upper deck back to back, longitudinally down the center of the car. The side walls of the car are braced together by carrying the floor of the upper deck upon forged steel rockers, which are bent upward at the center into an inverted U, to provide increased head room for the center aisle of the lower deck, an arrangement which gives over a foot of extra head room, and assists in keeping down the total height of the car. These steel rockers are attached by stout knees to the side posts, and materially stiffen the whole structure.

This particular car is of the completely inclosed type—suitable for winter travel. For summer travel it can be built with open sides, as is done on the cars in European cities. The question of stability has been carefully considered, and the lowering of the lower deck between the trucks, coupled with the weight of the motors which would be necessary with a car of this size, has kept the center of gravity at a safe height above the tracks.

DE GLEHN COMPOUND FOR THE GREAT WESTERN RAILWAY, ENGLAND.

The French compound locomotive for express service, mention of which was made some time ago in this journal, has been delivered, and is now giving good results on the Great Western Railway, England. The compound locomotive as such has been the subject of experiment and of a great deal of practical service on English roads for many years; but it is doubtful if any of the English-designed and built compound engines have given results as good as those secured with the De Glehn engines, which are used on several French roads for hauling fast passenger trains. The success of the French type is not due so much to any one particular feature, as to the fact that the designer has studied the question of compounding the locomotive from every standpoint, giving the most careful attention to details; and their high economy and large high-speed hauling capacity are due to the perfect balance and proportion of parts, producing a general, all-round excellence in the engine hitherto unattained. Particular attention was paid to the proportioning of the cylinders, and the ratio of high to low-pressure cylinders is widely different from that adopted on the Webb com-

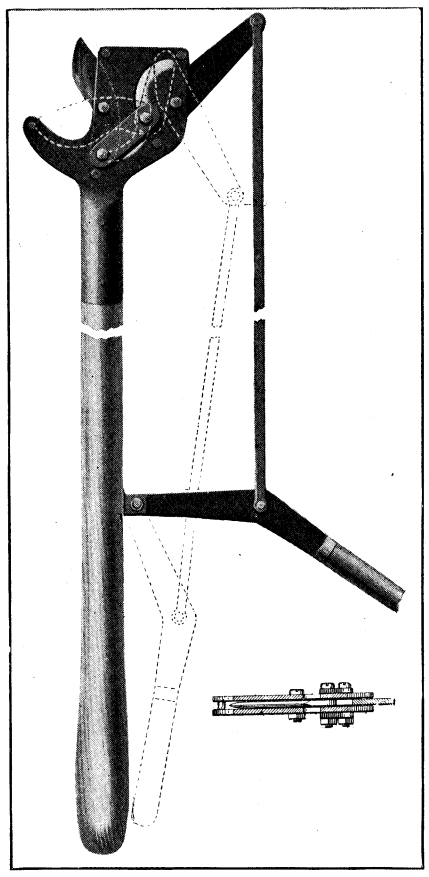


Cylinders: Two high-pressure, 13⅜ inches in diameter; two low-pressure, 22⅛ inches in diameter. **Steam pressure,** 227 pounds. **Heating surface,** 2,500 square feet. **Tractive effort,** 14 4 tons.

DE GLEHN COMPOUND LOCOMOTIVE NOW RUNNING ON THE GREAT WESTERN RAILWAY, ENGLAND.

pounds, which are the best known of the English compound engines.

The "La France," as she is called, was built by the Societe Alsacienne de Constructions Mecaniques of Belfort, France. The firm is building a large number of the same type for the Chemin de Fer du Nord, on whose line between Calais and Paris some of the finest records of these engines have been made. The distance between these two cities, 184¾ miles, is covered in three hours and fifteen minutes, in which is included time for one stop for a change of engines.



NEW PRUNING SHEARS.

The Great Western compound was built and erected at Belfort, then dismantled and shipped to the Great Western Railway Company's shops at Swinden, where it was re-erected and put in service. The likeness between the English engine and those of the Chemin de Fer du Nord will be apparent at a glance to readers of the SCIENTIFIC AMERICAN, who are already familiar with the French engines from the illustrations which have appeared in this journal. In order to divide the total stresses, and keep down the size and weight and reciprocating parts, steam is expanded in four cylinders, two on the outside and two on the inside of the frames, the outer high-pressure cylinders, which are 13⅜ inches in diameter, being connected to the rear pair of driving wheels; and the two low-pressure cylinders, which are a fraction over 22 inches in diameter, being placed between the frames below the smokebox, and connecting to a pair of cranks formed in the axle of the forward driving wheels. Provision is made by means of a valve controlled from the cab, by which the engineer can at will admit high-pressure steam direct to the low-pressure cylinders, a three-way valve in the cab serving to operate auxiliary valves on the high-pressure cylinders, by which the exhaust steam from these cylinders may be turned directly into the blast pipe. When the engine is running compound, this exhaust passes through the auxiliary valves into the low-pressure cylinders. The valve gear is of the Walschaert type, and provision is made for independently controlling the distribution of steam to the high-pressure and low-pressure cylinders by the manipulation of the reversing gear, thus rendering possible a wide range of expansion to suit the conditions of service.

The boiler is of the Belpaire type, and is fitted with the Serve tubes, the total heating surface being about 2,500 square feet. Under a pressure of 227 pounds per square inch, the theoretical tractive effort of the engine is 28,814 pounds. The tender is of the regular English six-wheeled type, with a capacity of 3,000 gallons of water. It must be admitted that this engine is of very handsome contour and general appearance, the only exception being the external pipe that straddles the barrel of the boiler just forward of the steam dome. The performance of this locomotive will be studied with great interest by the locomotive engineers of Great Britain. It is true that they are already familiar with the splendid results obtained on French railroads; but at the same time it is realized that a true comparison with their own engines will only be possible when both the English and French type are running, as they will be on the Great Western Railroad, under exactly similar conditions of service.

NEW PRUNING SHEARS.

We show in the accompanying engraving an improved form of pruning shears which has recently been invented by Mr. Alfred S. Boyd, of Rockville, Ind. This shears belongs to the class adapted for trimming the surplus growth of shrubs and trees, and the improvement consists in a new construction which affords a very strong, light, compact, and easily operated shears that can be very cheaply manufactured. As illustrated, the shears consists of a cutter head secured to the end of a long handle or pole, and is operated by a lever conveniently secured near the opposite end of the pole. The cutter-head consists of two similar steel plates, which are shaped at one side to form a cutter jaw. A shear blade is mounted between these plates with its outer end projecting above the cutter jaw. At its inner end this blade is provided with a pin whose ends project through S-shaped slots formed in the plates. The pin is connected by two links to a pin similarly projecting through these slots and secured to a rock arm pivoted between the plates at the opposite ends of the cutter-head. This construction is shown in section in our detail view of the cutter-head. A rod connects the outer end of this arm with the operating lever at the lower end of the handle. By moving the operating lever outward the shears will be opened as shown by full lines in our illustration. The shearing blade may be made to close down between the edges of the stationary jaw, by swinging the operating handle inward to the position shown in dotted lines. It will be observed that this construction affords a compound leverage for actuation of the shear blades, which is very powerful, so that the shears may be worked with ease, and small limbs of trees or shrubbery be cut without excessive labor.

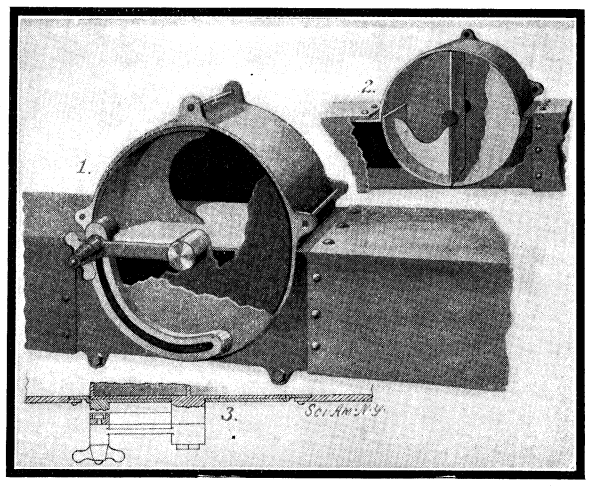
Death of the Oldest American Clockmaker.

On March 5, there passed away, at his home, in Dorchester, Mass., Edward Howard, the veteran clockmaker of America. Mr. Howard was born at Hingham, Mass., in 1813. In partnership with David Porter Davis, he established the first clock factory in this country, and later built the American Waltham Watch Works, at Waltham. Besides clocks, Messrs. Howard & Davis manufactured scales, and some of the first of these that they made were sold to the government and to various banks in 1849, for weighing California gold. Steam fire engines were a third object of this firm's activity. Mr. Howard was an inventor of note, and his is one of the few instances of an inventor living to the age of ninety years, and reaping the full fruit of his labors. At the time of his death he had not engaged in active business for the past twelve years, or since the incorporation of the great clock company bearing his name.

The figure of a huge elk constructed out of beans is one of the peculiar exhibits at the World's Fair. The bean elk comes from Ventura County, California.

AN IMPROVED GRAIN VALVE.

In designing a good grain valve, one is limited by certain requirements not met with in valves which are adapted to control the flow of fluids. The construction must be such that when the valve is being closed, it will not produce any shearing or crushing action on the grain, which would tend to break or smash the grains, and also the arrangement should be such that the grain can find no lodgment in any of the parts, and thereby choke the valve and prevent it from operating. These requirements are fulfilled in the valve which is illustrated herewith, and which is the invention of Mr. George J. Noth, of 913 West Fifth Street, Davenport, Iowa. The valve casing consists of a box, which fits at each end into the grain pipes or conduits, and whose upper wall is formed of a plate bent to the shape of a semi-cylinder. The side walls of the valve casing are outwardly offset, to receive two disks which form the side walls of the

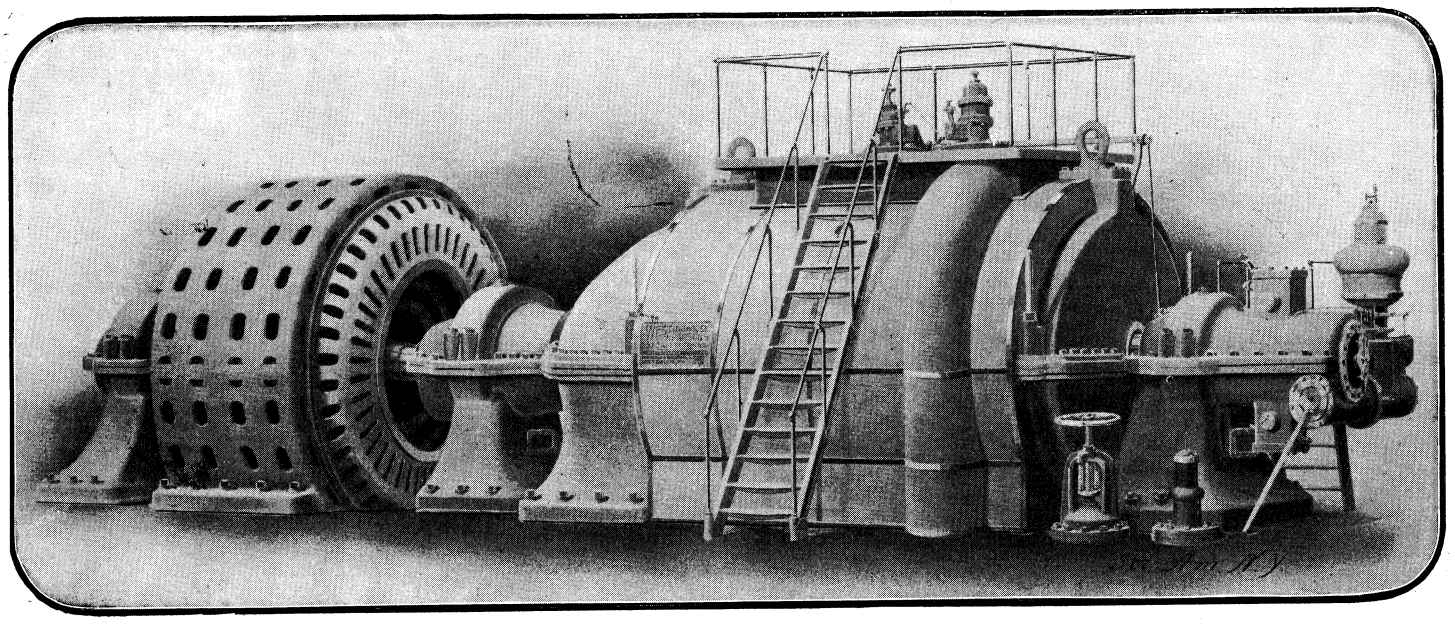


GRAIN VALVE.

valve proper. The purpose of this offset is to bring the surfaces of the disks flush with the walls of the casing, as shown in Fig. 3, and thus to prevent any lodgment of the grain at these points. The disks are connected by a diametrically-disposed plate, and also by a curved or quadrant plate, which extends from one end of the diametrical plate along the peripheries of the disks, through a little over a quarter of their circumference. The disks are formed with hubs, which find bearings in the side walls of the valve casing. Secured to the projecting end of one of these hubs is a lever which, at its outer end, carries a clamping bolt. The latter operates in a curved slot formed on the outer face of the valve casing, and provides a means for locking the valve in any desired position. In Fig. 1 the valve is shown in open position, with the diametrical plate lying horizontal, and offering no obstruction to the passage through the grain pipes or conduits. In bringing the valve to closed position, as shown in Fig. 2, it will be observed that the quadrant plate does not cross the path of the grain at a right angle during its entire movement; but it moves in an arc of 90 deg., approaching nearer to parallelism with the movement of the grain as the path is cut off.

STEAM TURBINE OF 11,000 HORSE-POWER.

When once the Parsons steam turbine had been introduced into this country, its development in size and power was very rapid. It will be remembered that the rights for the manufacture of this type in the United States were secured by the Westinghouse Company, and the sizes which they first constructed, some four or five years ago, were of 600-horse-power nominal capacity, direct-connected to 400-kilowatt, polyphase generators. The advantages of the steam turbine in economy and convenience, as shown by the subsequent operation of these first machines, were so substantial and unvarying that the company has not hesitated to sign contracts for the construction of turbines of 7,500-horse-power nominal capacity. These great machines, of which several are under construction for different concerns, will have a continuous overload



11,000-HORSE-POWER TURBO-GENERATOR FOR THE PENNSYLVANIA RAILROAD TERMINAL TUNNEL.

capacity of 11,000 horse-power in one self-contained unit, and they will therefore be comparable in power with the largest prime movers of the reciprocating type.

An idea of the compactness of the new turbo-generating unit, and of the simplicity and pleasing contour of the design, is obtained from the accompanying illustration, which represents one of several which are under construction for the great central power station of the new Pennsylvania Railroad tunnel from Jersey City to Long Island. These machines will furnish power for operating with electric locomotives the heavy Pullman trains which will enter the terminal station from the west, and also for running the elaborate system of suburban trains that will operate from the same station. Three complete 500-kilowatt units are also being built for the equipment of the power station of the Philadelphia Rapid Transit Subway system, which is now under construction. Eight units, with a combined turbine horse-power of 88,000, will furnish power for operating the London Underground system, while three 5,000-horse-power turbines are being built for the street railway system of the same city. All of these turbines will use steam at a working pressure of 174 pounds per square inch, with from 100 to 175 degrees of superheat, and they will be operated with the high vacuum which is a characteristic of the Parsons-Westinghouse turbine.

The advantages of economy of floor space characteristic of the steam turbine are strikingly illustrated in this large unit, for in spite of its maximum capacity of 11,000 horse-power, the space occupied by the turbine measures only 13 feet 3 inches by 27 feet 8 inches, which works out at 30 horse-power per square foot of floor area, based on the maximum overload capacity of 11,000 horse-power. It is not too much to say that the economy in space of the turbo-generator ranks second only to its economies of operation, as it requires only one-fourth of the space necessary for the most modern, vertical type of direct-connected, reciprocating units of equal electrical output. In units of say 1,000 electrical horse-power, the ratio of space occupied is as 1 to 10. The machine operates at the low speed for a turbine of 750 revolutions per minute.

The machine rests upon a single bedplate cast in two sections, which are held together by links shrunk on. Upon this bed-plate are bolted the pedestals, the generator casing, and the turbine body; but it may be mentioned, as a curious outcome of the fact that there are no reciprocating parts to disturb the equilibrium of the machine, that the bed-plate itself is not fastened to the foundations by foundation bolts, but depends for immobility upon its own weight. The barrel or cylinder is cast like the bed-plate in two sections, secured by shrunk-on links, and it is heavily lagged with non-conducting material.

The rotating parts consist of a central steel shaft, with a diameter at the journals, which are of the solid, self-aligning type, of 15 inches—a remarkable drop in dimensions from the 34-inch shafts of a cross-compound reciprocating engine of the same capacity. Upon this shaft is carried the mass of radial blades that form the rotating portion of this type of turbine.

Steam is led to the turbine successively through an automatic quick-closing throttle, a hand-throttle, a strainer, and the main admission valve. Provision is made for admitting high-pressure steam to the second stage of the turbine, when it is desired to increase its capacity by fifty per cent on overloads. The main admission valve is a double-beat poppet valve, controlled by a small pilot valve, that is actuated by the governor. The steam is admitted to the turbine in puffs, the duration of which is proportionate to the load. At the outer end of the turbine shaft is mounted a worm which drives a short, horizontal cross shaft that operates at one end an oil pump, and at the other end the governor. This pump supplies oil to all the journals.

At the time, two years ago, when the Scientific American illustrated the large 12,000-horse-power cross-compound reciprocating engines of the Manhattan Elevated central power station, in this city, we stated that probably these were the last engines of their size and kind that would be built for electric generation. If the great turbo-generators herewith illustrated show, as they undoubtedly will, the same and even higher economies than have been realized in the smaller units, they will undoubtedly become the future drive for electric power stations the world over.

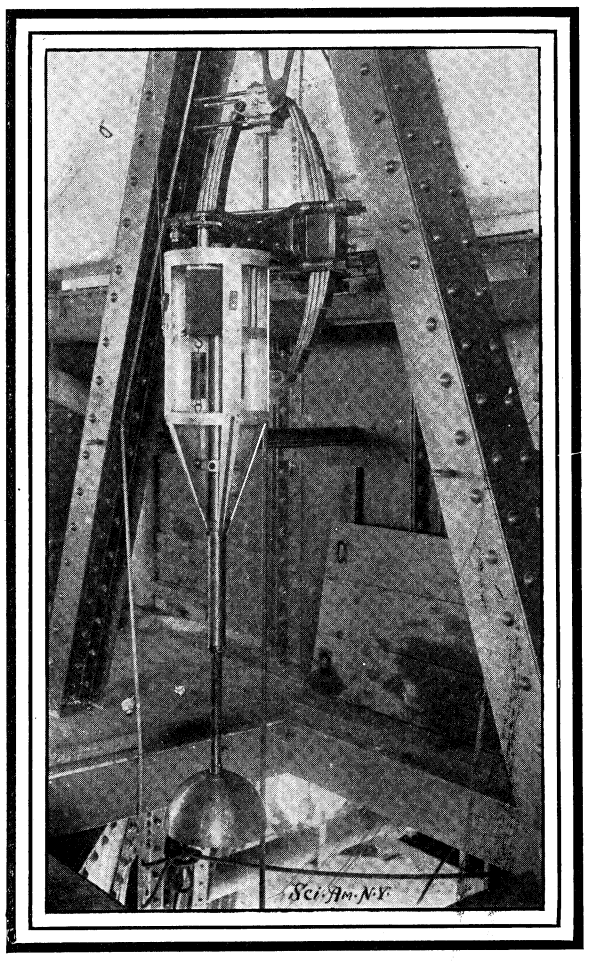
The Current Supplement.

A more interesting issue of the Supplement than the current number, 1472, has rarely been published. Mr. John N. Cobb, one of the agents of the United States Fish Commission, discusses at length the sponge fishery of Florida and illustrates his text with many interesting photographs. Articles which will surely be read by the antiquarian are those on purses and on watch-dials. Dr. H. Schweitzer's paper on some new photographic chemicals is published. An excellent review of Blondlot's N-ray experiments is given. A consideration of calcium steel, the new rival of ceramic products, gives many a curious bit of information. Prof. D. I. Mendelejeff, whose name will be forever linked with the periodic law that he discovered, recently read a paper which he called "An Attempt at a Chemical Conception of Universal Ether." An abstract of this paper is published in the current Supplement. Thomas W. Pritchard reviews the methods of distilling pine products now in use in our Southern States. "How to Build an Electric Oven" is the title of a practical article which will be found of value to amateur experimenters. The usual Engineering, Electrical, and Consular Notes will be found in their accustomed places.

EXPERIMENTS UPON THE PRESSURE OF WIND AT THE EIFFEL TOWER.

BY EMILE GUARINI.

Some very interesting experiments upon the resistance of the air have been recently made by M. G. Eiffel, at the tower which bears his name, by means of an apparatus of his invention which may be daily seen in operation when the air is calm. At a given signal, a cylinder carried by a double spring falls with great velocity from the second floor of the tower (that is to say, from a height of about 375 feet), along a vertical cable, and then progressively slows up, and stops without any shock at 3.28 feet from the ground, remaining attached to the cable. This cylinder, a part of which is conical, carries in front a plate which is thrust backward by the pressure of the wind



APPARATUS FOR MEASURING THE PRESSURE OF WIND.

during the fall. Such displacement compresses an accurately tared spring which measures the pressure and inscribes it upon a registering drum, the revolution of which is regulated by the fall itself. The ordinary inscribing style is replaced by a tuning-fork that makes 100 vibrations a second. When the apparatus is opened, there is therefore found inscribed upon the drum an undulating curve that gives for every point the height of the fall, the pressure acting at this moment, and the velocity, within an approximation of a hundredth of a second. This is the first time that one and the same apparatus has continuously indicated these various results from the zero velocity to that of 130 feet a second, which is that of the most violent winds.

As the pressure device may be of any form and size whatever (a normal or oblique plane, a cone, sphere or cylinder), the apparatus is capable of giving more accurate and certain results than have hitherto been obtained in experiments on the resistance that the air offers to a moving body, and which is nothing else than the pressure of the wind upon a stationary body.

Such determination presents great practical interest, either as regards the utilization of the pressure of the wind as a motor, or the resisting of it, as becomes necessary in the practice of the profession of the engineer and in experiments with dirigible balloons.

In order to complete the description of the apparatus, the principle of which has just been indicated, it suffices to add that in order to diminish the effect of the velocity of this mass of 265 pounds moving at the rate of 130 feet a second, say nearly 90 miles an hour, the frame of the apparatus is carried by a very powerful double spring which slides freely along the cable as far as to within 65 feet of the ground, at which point the diameter of the cable progressively widens and the double spring also is forced to widen, and then exerts a pressure upon the cable and, through its friction, gradually diminishes the velocity.

The experiments have shown that the pressure of the wind is notably less than that admitted up to the present. After they have been finished, this question, which has hitherto been very uncertain, will have made an important progress and have demonstrated once again the services that the Eiffel tower is capable of rendering to science.

Engineering Notes.

The North-Eastern Railroad of Great Britain has been experimenting with a new system of illumination for its railroad cars. The advantage of this system is that no wick is required, and there is a complete absence of smoke and smell. In this method gasoline is poured into a receiver which contains a specially prepared and patented absorbent block; this block absorbs the spirit, which in passing through it is vaporized. When the lamp is turned on, this vapor comes into contact with an ordinary incandescent mantle, and a brilliant flame of 50 candle power is obtained. One charge of the lamp furnishes enough gasoline vapor to last for eleven hours continuous light.

It is shown by the experiments of Dr. M. Ennslin (see Dingler's Polytechnisches Journal, Vol. 318, Nos. 50 and 51, 1903), that there exists a proportionality between the load and the elastic deflection up to a limit beyond which the latter will go on more slowly than the load. The total deflection, on the contrary, will increase more rapidly than the loads from a given value of the latter. It is shown that the coefficient of elasticity of the disks investigated is partly greater and partly smaller than the one of bars from the same material, this being most likely due to the following reasons: (1) The inaccurate knowledge of the longitudinal tension, as well as of the constants of elasticity, of the material in three perpendicular directions. (2) A singular state of internal stress, as due to the rolling process which is altered by annealing. (3) The influence of transverse strains on the deflection of the disk. Neglecting the latter would result in the coefficient of elasticity of the disk being found smaller than that of tension bars. Revising the theory of circular disks, he concludes that any objections which might be raised are incapable of exerting any material influence on the figures found by experiment. In order to establish a still more satisfactory accord between experiment and theory, the isotropy of the material should be more fully accounted for. The accuracy of the theoretical results within the limits of proportionality may anyhow be said to be sufficient from a practical point of view, but the author is not able to draw any conclusions with regard to the behavior of circular plates beyond these limits.

An interesting railroad relic, reminiscent of the first days of the steam locomotive, has been discovered in the north of England. The Liverpool & Manchester Railroad Company, the first public road constructed, it will be remembered, inaugurated a competition in the latter part of the twenties of the past century for a locomotive, in which Stephenson and other inventors participated. Three engines—the "Rocket," by Stephenson; the "Sans Pareil," by Hackworth, and the "Novelty," by Braithwaite and Ericsson respectively—participated in the trials that were carried out in 1830. As is well known, Stephenson's "Rocket" secured the award of $2,500 which was offered, as being the most suitable engine attaining a speed of 29 miles per hour. The "Sans Pareil" was second with a speed of 23 miles per hour, while the "Novelty" withdrew from the trials owing to the joints of the boiler giving way when the locomotive had traveled only three miles. Both the "Rocket" and the "Sans Pareil" are now preserved in the South Kensington Museum, but the "Novelty" mysteriously disappeared and was never found again until quite recently. It appears that Ericsson was so mortified by the failure of his conception, that he left it with his friend, Mr. Melling, who possessed engineering works located upon a space adjoining the Rainhill Station. These works were subsequently dismantled and the premises were occupied by the Rainhill Gas and Water Company. The "Novelty" was thus lost sight of, but it has now been recognized working as a stationary engine, the wheels having been removed for this purpose, and its identity thus somewhat disguised. Attempts are to be made to secure this third premier locomotive, and to place it alongside of its two contemporaries in the South Kensington Museum.

Correspondence.

Immunity From Consumption.

To the Editor of the SCIENTIFIC AMERICAN:

Pulmonary tuberculosis, or consumption, is the most common and dangerous of all diseases, in fact, the public statistics show that more than one-tenth of all deaths in the United States result from this disease, while between the ages of fifteen and forty-five the proportion is increased to thirty-three per cent, which means that one death in every three between these ages results from tuberculosis. Dr. Alfred Hillier, secretary of the British National Association for the Prevention of Consumption, has for many years made a close study of this malady. In his new book, he states that "deaths from tuberculosis in England and Wales are estimated to amount yearly to 60,000, and in the rest of Europe to a million. In England one-half the deaths between the ages of twenty-five and thirty-five are caused by this disease."

It is a well-known fact that tuberculosis is due to the tubercle bacillus, a vegetable micro-organism which is motionless and helpless, but under the proper conditions can grow and reproduce itself very rapidly. It has been estimated that in some cases, two or three thousand millions of tubercle baciili are discharged in the expectoration from a single case of consumption in the course of twenty-four hours. If such sputum lodges in places where it afterward dries and becomes pulverized, as on the street, floors, carpets, clothing, or handkerchiefs, these germs are liable to float in the air as an invisible dust, making it an easy matter for one to inhale them into his lungs. Everyone does inhale them more or less often, but if the lungs are fully developed and in a healthy condition, the germs will not prove harmful.

The tubercle bacillus requires an unhealthy tissue and a certain amount of moisture to favor its development, and the lungs are most frequently infected because they are seldom fully developed in the human being, and especially in women. This is due to the fact that the apex or top of the lung is seldom filled with air, and consequently the tissue in that part of the lung becomes weak and unhealthy, for want of use, and makes the best kind of a place for the rapid development of this dangerous germ.

For many years the medical profession of the entire world have devoted their thoughts and energies to the discovery of some cure for tuberculosis; but all efforts to cure the disease by drugs have utterly failed, and they now admit that the only thing that can be done is to give the patient plenty of fresh air, and adopt such strict sanitary measures as will prevent the spread of the disease to others. As pulmonary tuberculosis—consumption—is the most common form of this disease, and is due to imperfect development or unhealthy condition of the lungs, *why not make all children, and others, immune from the disease, by teaching them how to breathe properly, thus developing every part of their lungs, and making it impossible for the tubercle bacillus to live there?*

When the disease is once established, it is difficult to cure it, because the patient's vital force is so low that he does not have sufficient power of resistance to repel the disease. Small or unused lung capacity means low vital energy; but when the capacity is increased, the vital force also is increased, as well as the power of endurance, giving the person greater power to resist diseases of any kind.

The common nervous breakdown among children, as a result of overwork or too much mental strain, would seldom occur if the lungs were used as nature intended them. The matter of developing the lungs is very simple, and can be accomplished without any extra expense to the city or community. If all physicians would instruct their patients how to breathe properly, and if the boards of health and boards of education would compel all the schools to have their scholars rise in their seats and practise breathing exercises for a few minutes every morning, at the opening of the school, and at the same time tell them to practise these exercises on rising in the morning and at other times during the day, the result would be that their lungs would soon be in a healthy condition, and they would probably breathe properly during the balance of their lives.

If this rule was strictly carried out, the new cases of tuberculosis would soon be greatly reduced and, in a comparatively short time, tuberculosis would be substantially eradicated from our community. In the incipient stage of the disease, these breathing exercises will assist greatly in effecting a cure.

No elaborate breathing exercises or gymnastic movements are necessary to properly develop the lungs, in fact, one simple breathing exercise would be sufficient —the double-breath. This exercise is taken as follows: Stand erect, with the hands at the side, in line with the legs; take one long, full breath, hold it for a second, then take another quick, short breath on top of the other breath, and hold all for a second longer, then gradually exhale the air through the nose. All inhalations and exhalations should be through the nose, and not by the mouth.

There are a number of breathing exercises which will develop the lungs, but I mention this one as the best of all. Persons who are suffering from this disease, in an advanced stage, should practise the long, deep single breath for some time—several days or weeks—before attempting the double-breath, as the latter is only intended to develop the lungs of those who are not seriously ill. If you will try this double-breath exercise, even once, the extreme top of your lungs will no doubt experience, for the first time, the agreeable sensation of a "breath of fresh air." It is impossible for any one to contract consumption who will completely fill the air cells in his lungs with fresh air several times a day.

C. L. TOPLIFF.

New York city, March 10, 1904.

THAWING OUT FROZEN WATER PIPES BY ELECTRICITY FROM STORAGE BATTERIES.

In a recent issue of this journal we described a method of thawing out frozen water pipes by means of alternating current transformed down to a voltage of 50. While the apparatus described makes it possible to do this expeditiously where alternating current is available, there are nevertheless many instances where such current cannot be obtained. In such cases it is quite feasible to employ storage batteries as a source of current, as these can easily be carted to the place where the current is needed and be made to supply sufficient for quickly thawing out any ordinary water pipe.

Mr. T. D. Bunce, president of the Storage Battery Supply Company, of this city, recently made use of forty-eight 200-ampere-hour cells of battery for thawing out a ½-inch service pipe and a section of a 2-inch main in Borough Park, Brooklyn. The diagram shows the connections that were made for thawing out the former, while the main between the two service pipes was afterward thawed out by attaching the wire seen running to the house to it at *I*.

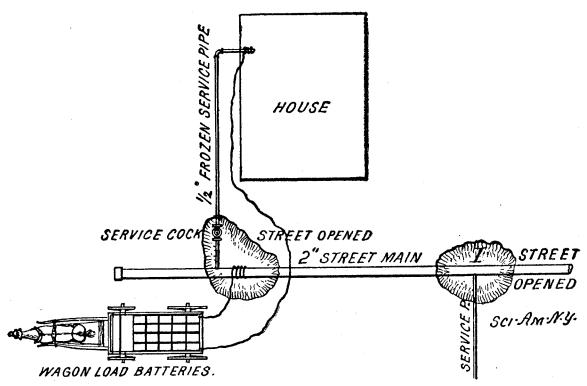


DIAGRAM OF CONNECTIONS FOR THAWING WATER PIPES WITH STORAGE BATTERIES.

Before attempting to use storage batteries for this purpose, Mr. Bunce first carried on some experiments to determine the amount of current and the voltage required to thoroughly heat an iron pipe. He connected two 10-foot lengths of ¾-inch iron pipe with a ¾-inch tee, plugged the outer ends of the pipe, filled it with water, and inserted a thermometer in the tee. This showed the water to be at a temperature of 39 deg. F. Connections were made to the ends of the pipe from two storage battery cells (4 volts) by means of heavy copper cables, and the ammeter registered 185 amperes, while the voltage at the ends of the pipe was 2½. The drop in voltage was due partly to the resistance of the wires and pipe, and partly to a lowering of the voltage of the cells under the heavy discharge. Kept up for 10 minutes, this flow of current raised the temperature of the water only 2 deg., and the pipe was not so hot but that a person could hold his hand on it without burning. Three cells were next connected in series, giving an additional voltage on open circuit of 2 volts; and the result of this addition was to send 260 amperes through the pipe. Flowing for 10 minutes, this current raised the temperature of the water 18 deg., or to 59 deg. F., and the pipe was uncomfortably hot to the touch.

With this data as to the voltage and current required to quickly heat an iron pipe, Mr. Bunce had his battery carted to the house where the water pipe was frozen. The joint of the service pipe and main was uncovered, and a connection was made from the battery to the main by means of a heavy wire cable and a special strap and clamp. The other terminal of the battery was connected to the ½-inch service pipe where it came through the cellar wall. The cells were arranged in series and multiple, so as to give a voltage of 16. The current was over 300 amperes at the start, and gradually fell to this figure. It was kept on for 20 minutes, so as to make sure of thawing out the large brass service cock as well as the pipe. The temperature of the latter rose rapidly, until, at the end of 20 minutes, the pipe was too hot to hold in one's hand. As no water flowed, the conclusion was reached that the main was frozen. The house was the last one on the street, and the main ended just beyond it. At the next house the water was running, showing that the main was frozen only between the two houses. Consequently the wire which had been run to the house was clamped to the main at *I*, the cells were arranged in 16 sets of 3 each, connected in multiple, thus giving 6 volts and each cell furnishing one-sixteenth of the total current. This was probably in the neighborhood of 2,000 amperes. It was kept on for 3 minutes before the water began to flow.

These experiments demonstrate that the amount of electric energy needed to thaw out water pipes is much smaller than was stated in the previous article on this subject, which we published two weeks ago. The experimenter there stated that 11 to 15 kilowatts were necessary to thaw out a ¾-inch 30 or 40-foot pipe in from 5 to 8 minutes. Mr. Bunce used only about 4½ kilowatts to thaw out 70 feet of ½-inch pipe, and probably about 10 or 12 kilowatts to thaw out 20 feet of 2-inch main. The fact that with storage batteries there is no loss of energy in a rheostat or transformer doubtless accounts for this considerable difference. The batteries have a decided advantage in this respect, as the proper voltage for thawing a certain length of pipe can be obtained, thus making auxiliary resistance unnecessary.

Electrical Notes.

A remarkable instance of the durability of electric pumps is reported from South Africa, where, in the mining districts, electricity and compressed air are fighting for supremacy. It was after the cessation of hostilities that the two shafts of the Knights Deep mine were found to be flooded out. The plant and other apparatus had been left just as they were before the war broke out, and the electric pumps and cables which were used at the mine had been under water for quite two and one-half years. Notwithstanding, the motors were brought out, dried, and set to work again. The firm who supplied the motors is not mentioned, but their name deserves to be placed on record.

The new White Star liner "Baltic" is probably better equipped electrically than any other boat either afloat or building. In addition to the usual electrical appliances to be found on board present-day ocean liners, the "Baltic" is equipped with an electrical device for preventing collisions with other vessels. The moment another ship enters the "magnetic field" of the "Baltic" the needle of the indicating instrument points in the direction of the vessel approaching or being overtaken, and the steersman knows at once what course to take. Even the rhythmic beats of an unseen steamer's screws are registered by means of this delicate apparatus. Another safeguard is an electrical contrivance to show if the ship's lights are burning properly. An electric log for ascertaining the speed of the ship is another acquisition, and an electric lead for ascertaining the depth of the water is also on the list. There is, further, an electric device for registering all signals, including steam sirens. The "Baltic" is equipped with electric refrigerating as well as electric cooking apparatus.

Series motors approach to some degree the elasticity of steam engines, but for their dissipating in starting part of their energy on passive resistance. As these motors should therefore be fed at variable voltage, monophase motors seem to be especially available for electric traction purposes, allowing of high-tension currents being used, and necessitating only one feeding wire, in addition to the rails serving as the return circuit. The series monophase motor designed by Dr. Finzi (Elettricista, November, 1903), when working at constant voltage, automatically regulates its speed according to the load, the speed being inversely proportional to the latter for high values of the torque required. It permits of the regulation of the voltage when starting being effected without losses, and of the speed being varied within very extensive limits. On the other hand, it is not able to use directly high voltages, and is at present only applicable to relatively low frequencies. The characteristic curves of the motor, as given in the original paper, have several advantages. Thus, comparing the monophase and continuous-current motors designed for speeds of 22 kilometers per hour, the former will require in starting 9.4 watt-hours per ton, whereas the figures necessitated by the direct current motor are as high as 12.35 watt-hours. As regards the energy absorbed during a trial run by the two motors under equal conditions, for mean speeds of 17.5 kilometers per hour and about 2¼ starts and stops per kilometer, the integrations of the diagrams give for the monophase car, weighing 9.45 tons, 45 watt-hours per ton-kilometer, and for the continuous-current car, weighing 9.65 tons, 70 watt-hours per ton-kilometer. Calculating the power factor from the experimental curves obtained, the value 0.7 was obtained in starting; whereas at the generating station the power factor, including the line, transformer, and motor, averaged during the run 0.8, varying between 0.6 and 0.95.

ELECTRICITY IN THE HOUSEHOLD.

In this, the electrical age, no new house is considered complete unless it be fitted with electric lighting circuits, whether the owner intends to use electricity or gas as an illuminant. And yet the incandescent lamp has been in practical use but little over a score of years. But aside from its utility for illuminating a building, and for running an electric fan, the electric circuit offers many other advantages which the public is only just beginning to appreciate. The accompanying illustrations show what a variety of uses the electric current can serve in an up-to-date home. The fatiguing treadmill operation of the sewing machine is done away with and the work is performed by a little electric motor about a foot high and six or seven inches broad, which gets its power from the ordinary lighting circuit and, changing this to mechanical movement, transmits it to the sewing machine through a friction wheel bearing on the starting wheel of the machine. The speed can be very delicately regulated by means of a small lever and the machine can be as quickly started or stopped as by foot power. As shown in our illustration the operator can assume any easy, comfortable position, as the only duty required is to steer the cloth under the needle. Even an invalid can safely operate a machine thus driven.

The electrically-heated flatiron shown in another illustration possesses the advantages of maintaining an even temperature which continues as long as the device is connected with the electric circuit. The iron heats up in a few minutes and is very handy especially for occupants of flats and apartments in laundering small articles. It is also particularly useful for pressing a crease in a pair of trousers and smoothing out the wrinkles in a coat and vest.

One of our illustrations shows an electric "hot-water" bag, which might better be termed "hot-wire" bag, for instead of being filled with hot water, it contains coils of fine flexible wire which are heated on passing the current through them. The bag heats up in five minutes, and as is the case of the electric flatiron it possesses the advantages of yielding a uniform degree of heat as long as it is in use. This is certainly a long step in advance of the hot-water bags now commonly used, which have to be refilled with hot water every fifteen or twenty minutes, and even then a uniform heat is not maintained.

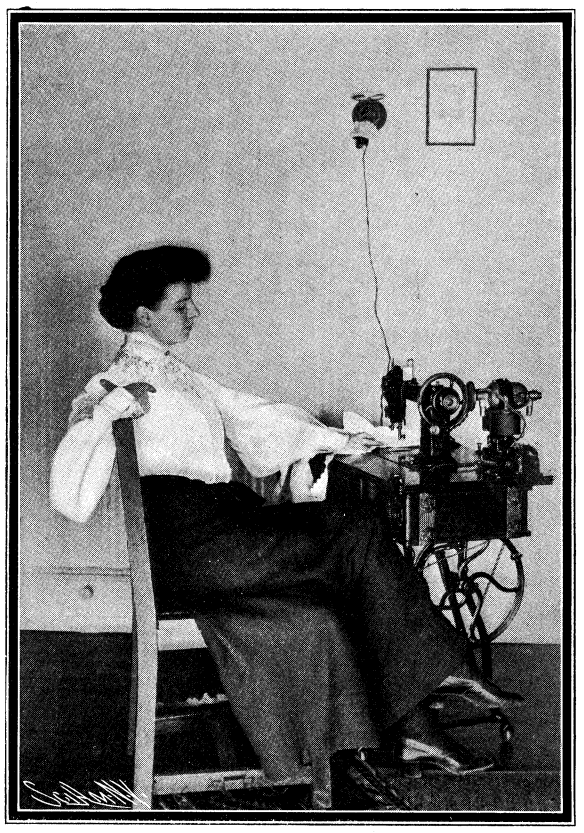
Electric curling-iron heaters are to be found on the dressing tables of many fashionable hotel bedrooms. They are small and neat and they work automatically. The slipping of the iron into the heating chamber turns the current on and the withdrawing of the iron turns it off. They are popular because they do away with black smears of soot that the heating of a curling iron in a flame of gas occasions.

The electric chafing dish shows still another use of electricity in the home. It is really a small stove which can be regulated at will to give the desired intensity of heat. A traveler will find this stove particularly useful. It can be carried in the overcoat pocket and in a hotel room, on a train, on board steamer, or wherever electricity is available the little stove can be set up and used for preparing coffee, tea, Welsh rarebit, etc.

Aside from the electrical devices illustrated herewith, there are many others which are coming into practical use. Electric griddles, cake irons, toasters, cereal boilers, and coffee urns are but a few of the many devices which are now finding their way into homes equipped with electricity. None of these contrivances calls for more than three-quarters of a cent per hour to operate, and besides their cheapness, their cleanliness, and their handiness, they have the additional quality of absolute safety. Insurance companies recommend them and the insurance rates are lowered where they are in use.

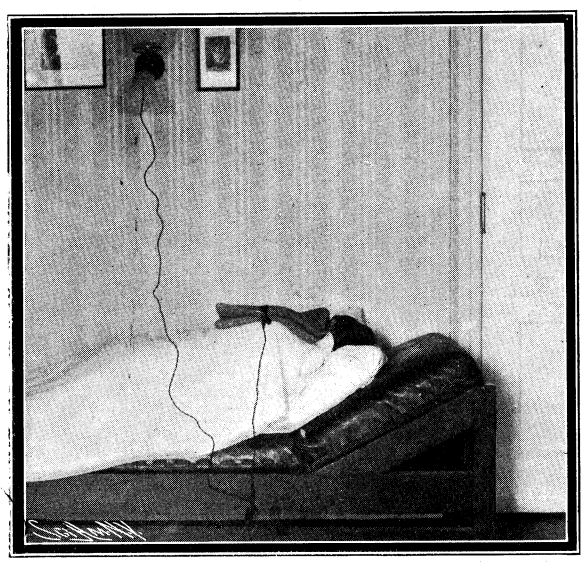
New System of Measuring Criminals.

The police of London have introduced experimentally a new measuring system for recognizing criminals. As it has been successful, it will soon be adopted by a number of other police departments both in England and abroad. In this system only the impressions of the fingers are taken. Compared with the Bertillon system, it has, above all, the advantage of simplicity, as it can be applied without any contrivances, and is, therefore, much less expensive. Whether it can completely take the place of the Bertillon system remains to be seen. The Berlin police have for the present also inaugurated a card collection of impressions of the fingers for recognition purposes. The new system is called "Daktyloscopy."—Richard Guenther, Consul-General, Frankfort, Germany.

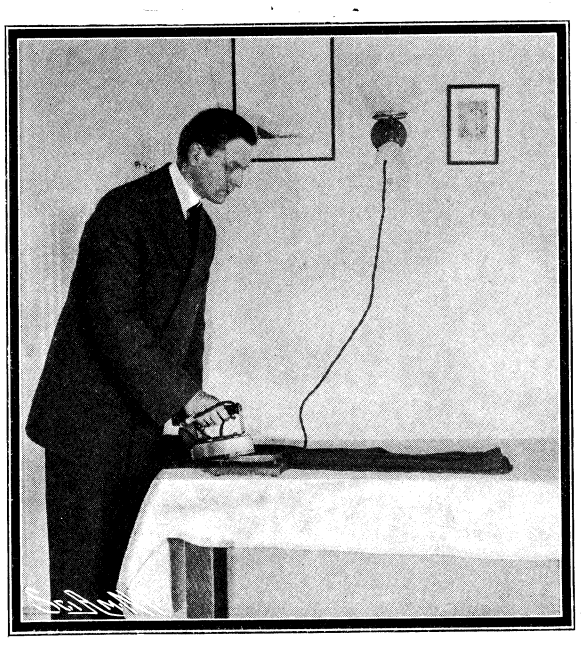


Sewing Machine Run by Electric Motor.

The Electric Chafing Dish.



The Electric "Hot-Water," Bag.



Pressing With Electrically-Heated Flatiron.

The Electric Curling-Iron Heater.

ELECTRICITY IN THE HOUSEHOLD.

OUR KNOWLEDGE OF THE MOON.*

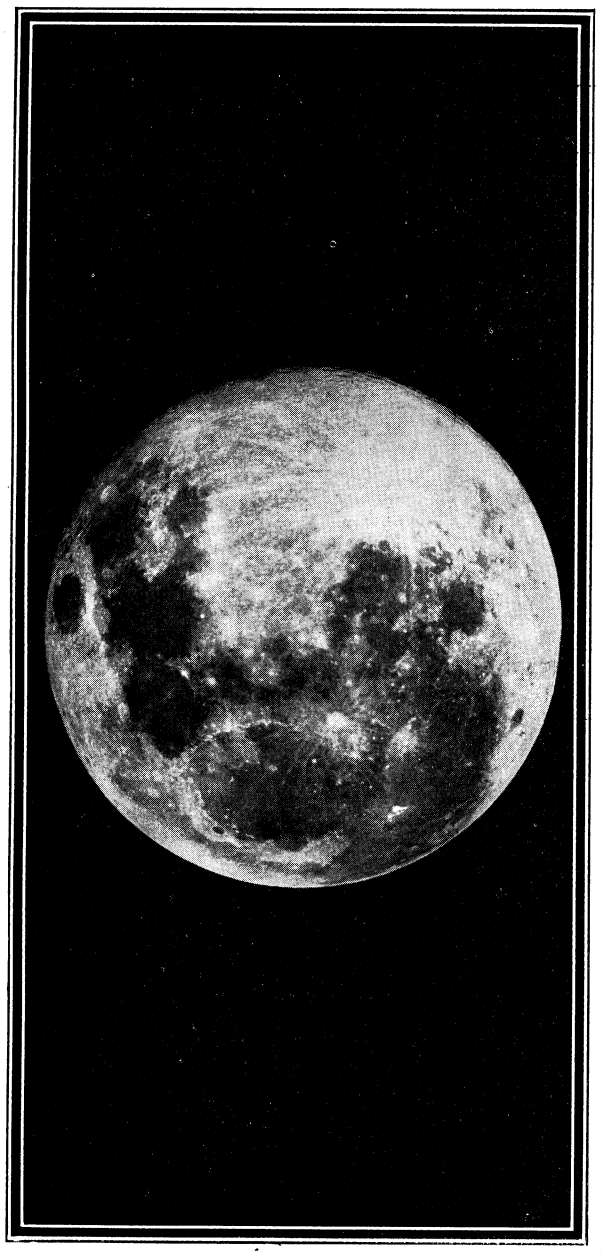
Prof. Pickering's book on the moon, although essentially a popular work, is nevertheless an important contribution to the literature of a subject which has been made the object of ceaseless study even before astronomy had developed into a science. Based as the book is on very recent observations carried out by Prof. Pickering through the aid of Harvard University's observatory, and particularly on a splendid photographic atlas of the moon's surface prepared under Prof. Pickering's direction, it cannot but meet with the reception that it deserves. Astronomers who seek more technical information can find it in the Annals of the Harvard observatory; but the man who has a leaning toward science but who has not sufficient astronomical training to warrant a perusal of the more pretentious annals, will find here just what he needs—an accurate, and withal a confessedly popular account, of what astronomers have discovered on the surface of the earth's satellite. With this brief expression of opinion, we may be permitted to pass to a general review of the contents of Prof. Pickering's work.

Just what may have been the origin of the moon has been the subject of much speculation. The most currently accepted theory, however, is that the moon is supposed to have been originally part of the earth, and that in some way it has broken off from the parent mass. We are certain that when the earth was still a plastic mass the terrestrial day was much shorter than it is at present. As the original earth cooled, and contracted from its nebulous form, its rate of rotation must have steadily increased, and with it its centrifugal force. The powerful solar tides which then existed, however, did much to reduce this increase. The final period of rotation was shortened to about three hours. Gradually, the force of gravity at the equator became less and less. The solar tides in consequence became higher and higher. One day a cataclysm occurred, the like of which this earth has never seen before or since. Five thousand million cubic miles of material were hurled from the earth's surface by centrifugal force, never again to return to it. The somewhat fanciful suggestion has been made that the great depression occupied now by the Pacific Ocean indicates the spot which was filled by the moon, and that the eastern and western continents were cleft in twain when that great division occurred, floating like two huge ice floes on the denser, partly metallic fluid of the earth's interior. These huge depressions, when the surface had sufficiently cooled, were afterward filled with water, according to this theory, thus forming other existing oceans.

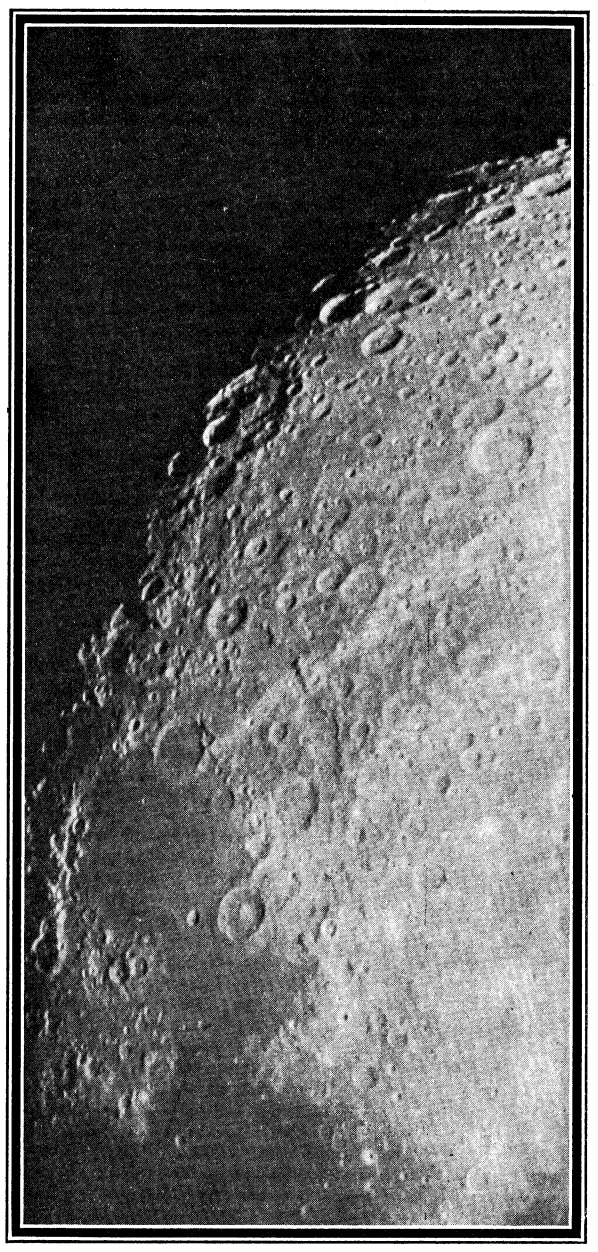
When did this separation of the moon and earth occur? It must have been rather recent in astronomical chronology. It is certain that the earth must have been already condensed from a huge gaseous mass to a comparatively solid or liquid form, very near its present size. The moon is probably one of the younger members of the solar system. Still, astronomers estimate its age at something like fifty million years.

When it first began its journey around the earth, the moon could not have been spherical; for the earth would not have permitted so large a body to retain its shape so near its own surface. The moon's present form was probably assumed after it had escaped to a distance of a few thousand miles, a distance that constantly increased and will continue to increase within certain well-defined limits. When our satellite has retreated to about 350,000 miles, the length of a lunar month will be increased to fifty of our present days; and our day will also have been increased fifty-fold. The earth and moon will constantly turn the same face toward each other as

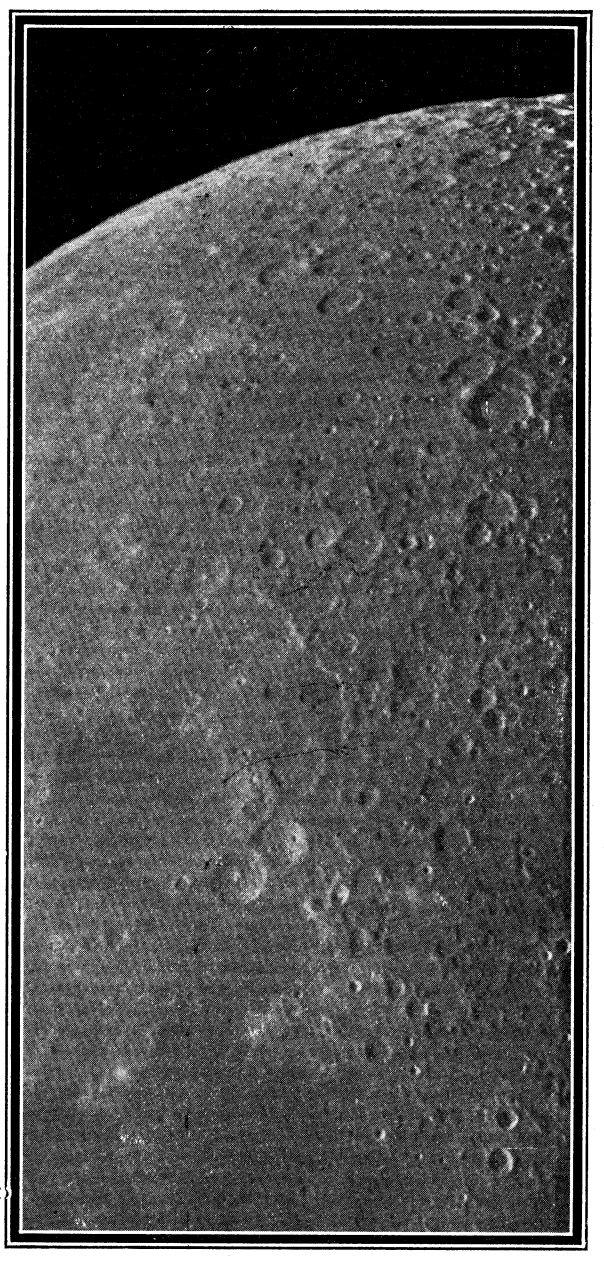
* The Moon. By Prof. William H. Pickering. New York: Doubleday, Page & Co. 1903.



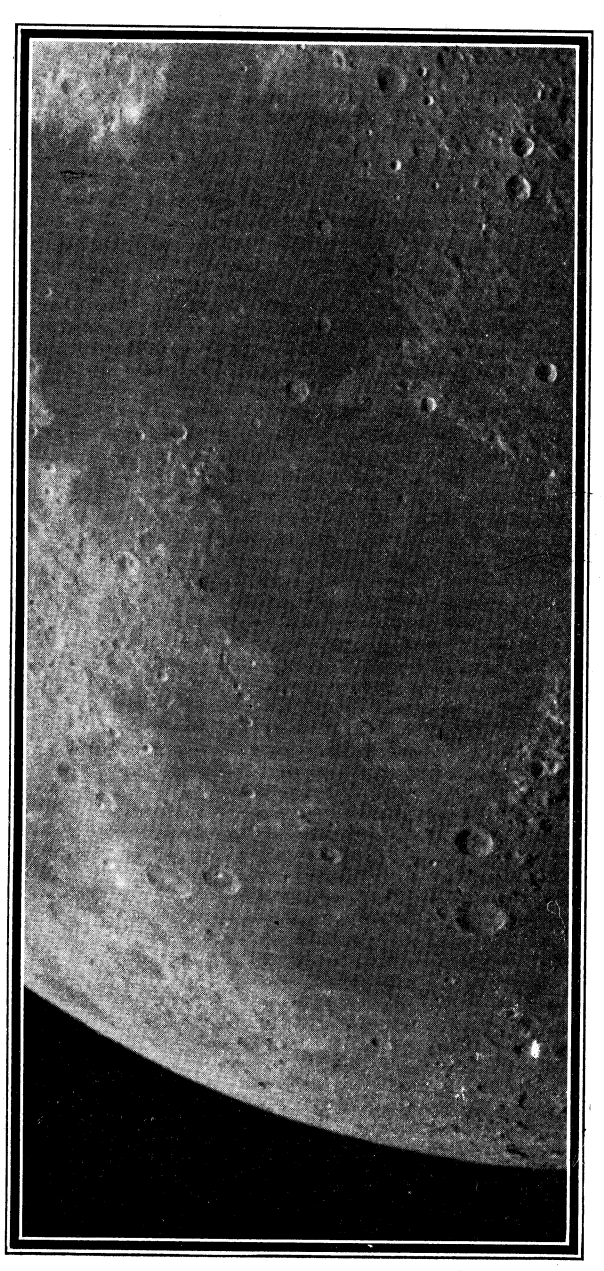
The Full Moon.



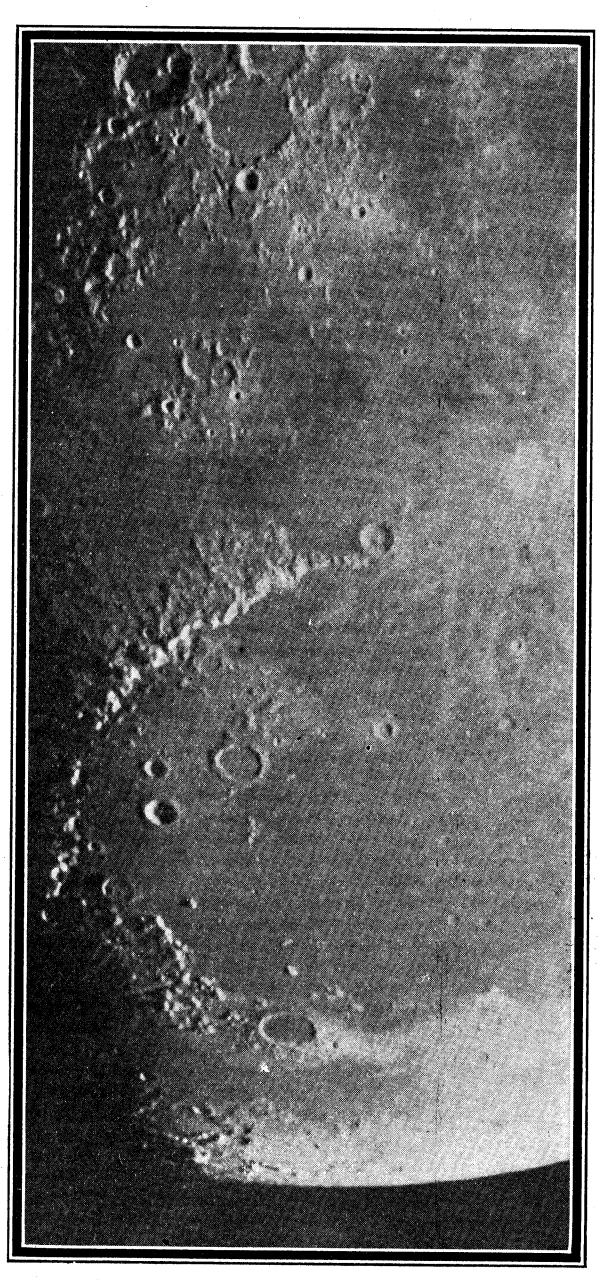
Piccolomini. Theophilus.



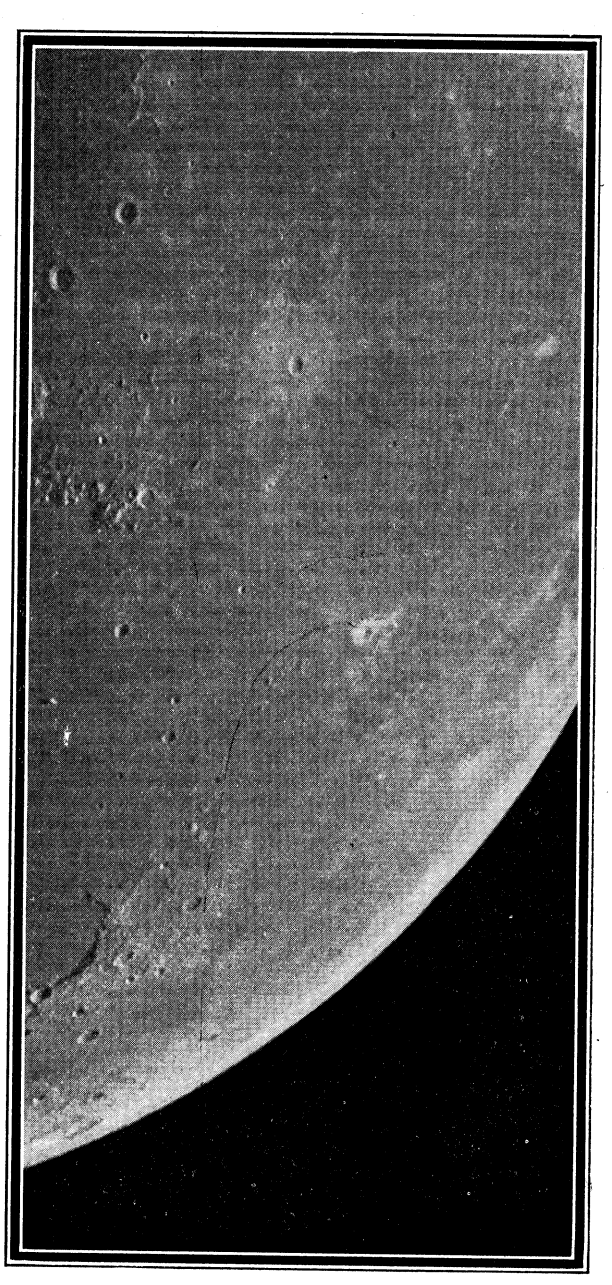
Piccolomini. Theophilus.



Mare Tranquillitatis. Mare Serenitatis.



Mare Imbrium. Plato.



Kepler. Aristarchus.

The entire surface of the Moon was carefully mapped out and photographed five times, under the direction of Prof. Pickering, on the Island of Jamaica.

PART OF THE HARVARD PHOTOGRAPHIC ATLAS OF THE MOON, SHOWING SOME OF THE MORE PROMINENT CRATERS.

they did from the very beginning. This conclusion is based upon the assumption that when this event occurs, we shall still have seas and tides, of which fact, however, astronomers are by no means certain.

From time immemorial, it must have struck astronomers that the moon always presented the same face toward the earth, a phenomenon which is to be explained by the fact that the moon rotates on its axis in precisely the same time it revolves around us in its orbit. The cause is to be found in the tides—not our tides raised by the moon, but the moon's tides raised by the earth. It has been concluded by astronomers that the great lunar tides of that early period were not tides of water, but of molten rock, rising not merely a few feet every twelve hours, but many miles—so fearful in the gigantic force which they developed that they quickly retarded the rotation of the moon. Soon it happened that the moon ceased to turn with regard to the tides. Thus it came about that the moon's period of rotation on its axis and its revolution about the earth were made to coincide.

These great tides must have ceased ages before the human race was born. They have probably left their permanent mark upon our satellite. Very likely its surface is not spherical, but slightly elongated in the direction of our earth. If the moon's time of revolution begins to exceed that of its rotation, the earth's attraction on this projecting surface will retard its rotation by just the proper amount to bring about a coincidence with exactly the same result that a tide would have had.

The greatest distance from us that the moon ever reaches is 253,000 miles; the nearest it ever comes to us is 222,000 miles. The time required by the moon to travel around the heavens until it arrives at the same point again is 27 1-3 days. This, the true period of revolution, is called one sidereal revolution. The time required by the moon to pass from full moon to full moon, or from any other phase to the same phase is 29½ days, which period is called its synodic revolution and is usually referred to as the lunar month. Both periods are subject to slight variation.

The phases of the moon may be explained by the fact that the moon is a dark spherical body which shines only by reflected light. Astronomically speaking a new moon occurs only when the moon is between us and the sun, and is, therefore, invisible. The new moon, popularly so called, is seen only when the sky is sufficiently dark to present a complete outline of the disk. This illumination is due to the light which comes first from the sun, is reflected to the earth and back to the moon, and thence to the earth. What we really see is the earth light shining on the moon.

Because the moon moves at different speeds in different portions of its orbit, while its axial rotation is uniform, it happens that we sometimes see a little further around one edge of the moon and sometimes around the other—a phenomenon which is called by astronomers the moon's libration, that is, its balancing in longitude. There is also a libration in latitude, which is caused by the moon's turning sometimes one pole toward the earth, and sometimes the other. These librations enable us to see just a little of the other side of the moon, about nine per cent perhaps; but the rest must remain forever invisible.

Although the moon's velocity in its orbit compared with that of some other celestial objects is comparatively low, yet its speed, compared with our terrestrial standards, is enormous. It moves with a mean velocity of 3,350 feet per second—a little faster than the highest speed yet given to a cannon ball.

The mass of the moon is about 1-80 of that of the earth. Notwithstanding its smaller size, the bodies on the moon are much lighter than they would be here. The ratio is almost exactly one-sixth. A man who weighs 180 pounds on the earth would find that he weighed only 30 pounds on the moon. He could carry two men at once on his back for 20 miles, much more easily than he could walk that distance without a load here. He could throw a stone six times as far as on the earth. He could jump over a moderate-sized house or tree, and would not consider the feat at all wonderful.

The moon is commonly considered a body without life, without an atmosphere. According to Prof. Pickering, however, it is not altogether so lifeless as we once supposed. Astronomers have never been able to detect the slightest refraction of a ray of light coming from a star and passing very near the moon's surface—a test which was at one time considered proof positive that the moon could have no atmosphere. When, however, an atmosphere becomes extremely rare, we are not sure just what will be the effect upon the refraction. It is barely possible that the moon may have a much denser atmosphere than observation might seem to indicate. Refraction in the case of the moon is extremely slight, so slight that it is quite immeasurable. It has been assumed that the moon's atmosphere, if it has one, is about 1-10,000 that of our own. The strongest evidence that we possess of a lunar atmosphere based on direct observation is found when the moon occults a bright planet, such as Jupiter. Under these conditions a dark band is always seen crossing the planet, tangent to the edge of the moon. This absorption is never seen at the dark limb of the moon, indicating that the absorbing medium, whatever it is, is condensed to a solid by the intense cold that must prevail during the lunar night.

When the moon parted company with the earth, the two bodies doubtless divided their own atmosphere in proportion to their respective masses. But since the force of gravity on the moon's surface is but one-sixth that of the earth's surface, the density of the lunar atmosphere must have been only one thirty-sixth that of the earth's. But even this is 300 times more dense than we actually find it at the present time. The lighter gases have been escaping from the moon for ages with considerable rapidity, leaving behind the denser gases, a process which is also occurring on the earth, but much more slowly. If the moon has an atmosphere, of what is it composed? Oxygen and nitrogen would escape from the moon's atmosphere as rapidly as hydrogen does from the earth. Carbon dioxide gas on account of its heaviness is more readily retained and is probably to be found on the moon is considerable quantities. It is likely, however, that any gas not constantly renewed from the moon's interior would have disappeared from its surface long ago. The moon's atmosphere consists probably of water vapor and carbon-dioxide gas. There may be an amount of carbonic acid (which is to plants what oxygen is to animals) in a cubic foot of the moon's atmosphere much larger than that contained in an equal bulk of our own.

According to Prof. Langley, the temperature of interplanetary space cannot be far from that of absolute zero or 460 degrees below zero in the Fahrenheit scale. This is probably also the temperature of the night side of the moon. What the temperature of the day side may be, under a vertical sun, has not been determined with much exactness. Sir John Herschel and Lord Ross thought that it might exceed that of boiling water. Prof. Langley considers it very uncertain, but probably not far from the freezing point. Prof. Very has shown that the moon is at least harder than the snow upon its surface.

To the selenographer, the moon's craters are perhaps the most interesting objects of study. Whether any of these craters are still active has not as yet been accurately determined. Some observers claim to have noted effects of volcanic disturbances. A careful study of some of the craters affords proof that some of the volcanoes may not be extinct. Prof. Pickering has studied dense clouds of white vapor that apparently arose from the bottom and poured over the southeast wall of what is known as Schroeter's Valley, and has obtained evidence which would seem to prove that regularly occurring lunar changes of some sort are in progress.

If there be any active volcanoes on the moon, it is evident that they must expel something. That something, if we may judge by the volcanoes on the earth, is water vapor and carbonic acid gas. We have seen that the moon's temperature has been estimated at —460 deg. F. Obviously, water in the liquid state can hardly exist at that temperature, for many craterlets on the moon are lined with a white substance which shines brightly in the sun. A white substance which lines some of the larger lunar craters is also found on a few of the higher lunar peaks. Besides these very bright patches, there are other regions less brilliant, but exhibiting the curious phenomena of being invisible for the first twenty-four hours after sunrise, and gradually appearing as the sun rises higher and higher, becoming fairly conspicuous at the end of a couple of terrestrial days and then fading and disappearing before sundown. The most striking appearance, however, consists of long bright lines radiating in all directions—in some cases for hundreds of miles—from a central crater. These white patches are thought to be snow, invisible except when illuminated by the direct rays of the sun, because the lunar sky is absolutely black on account of the rarity of its atmosphere. The fact that these white patches gather at the pole on the mountain peaks would seem to indicate that snow does fall upon the lunar surface.

If the moon has an atmosphere of which water is not the least important ingredient, there is no reason in the nature of things, why organic growth on its surface should not be possible. Moreover, the presence of carbonic acid gas on the moon as a supposed ingredient of this atmosphere would lead one to infer that vegetation of some kind might exist, since carbonic acid is the food of plants. It may be objected that the rarity of the atmosphere would preclude the existence of organic life. To this it may be replied that certain forms of vegetation on the earth often subsist for years without water. On the antarctic continent, for example, a certain lichen grows at a temperature that rarely rises to the freezing point. If there be vegetation upon the moon, it would have certain advantages over our own. In the first place, the low lunar specific gravity would enable the leaves or branches to lift themselves with one-sixth of the effort required on earth. The absence of high winds upon the moon would permit a plant to rise above the surface of the ground without clinging close to the rocks as it would have to do in our arctic regions. Whether or not there really is vegetation on the moon's surface is a matter of some dispute. Prof. Pickering believes that there is, basing his belief upon observations of what he has called "variable spots"—portions which exhibit a rapid darkening, beginning shortly after sunrise, followed by an equally rapid fading toward sunset, accompanied by a diminution in size as they darken. From the peculiar character of the variation observed, Prof. Pickering concludes that organic life resembling vegetation is the only simple explanation of the changes which he has observed. Considering the long lunar day as a miniature terrestrial year, the theory of such life becomes colorable. The vegetation, if there be any, shoots up, flourishes and dies in a lunar day just as it grows and withers on the earth in a terrestrial year.

"Canals" are usually associated with the planet Mars. Still there is some evidence that the moon too has what may be called its canals, although on the whole, the lunar canals are much smaller and perhaps broader in proportion to their length than those of Mars. Yet on account of the clearness of the moon, its canals are much more readily studied than those of Mars. These canals, according to Prof. Pickering, may be accounted for on the planet Mars by processes of vegetation. The formation of the lunar canals may likewise be explained by the presence of plant life. The study of these canals of the moon is important, chiefly for the light it may throw upon a similar phenomenon of Mars. If they are due to vegetation, and if, indeed, it can be definitely proved that vegetation does exist upon the moon, it shows with what remarkable tenacity life clings even to a body that is nearly dead. The conclusions as to the existence of vegetation and an atmosphere on the moon are largely Prof. Pickering's. It is doubtful if they will find ready acceptance by most astronomers; still the proof which he has advanced of the soundness of his theories is at least interesting.

The photographic atlas of the moon, which forms perhaps the most important part of Prof. Pickering's book on the moon, corrects many errors in prior maps, which have been made from observation. The accompanying illustrations show with what painstaking care the work of taking photographs of the moon by the Harvard College astronomers has been carried out. From the number of photographs taken, Prof. Pickering concludes that the total number of craters and craterlets possible upon the moon, under variable conditions, exceeds 200,000, but is less than one million.

Prevention of Fire in Theatres.

In a paper recently published in Dingler's Polytechnic Journal (No. 5), C. Wegener draws attention to the fact that the amphitheatre being the best possible "ventilating pipe" of the point of origin of a possible fire, a radical alteration of the ventilating conditions in theatres would be the most fundamental requirement. The dangers of locating the main ventilating tube above the amphitheatre are pointed out, the hot, and accordingly rather expansive, gases as produced in the case of a fire on the stage being instantaneously sucked through the amphitheatre. Fireproof curtains would be quite illusory in the case of a similar arrangement of the ventilation both in the case of their being of asbestos and of iron, this being the cause of the inefficiency of the asbestos curtain in the Chicago disaster. Moreover, a partial lowering of the asbestos curtain must result in the ventilating effect being increased, as the fire gases, after being momentarily stagnated, will in the next moment issue from below the curtain with elementary force, igniting all they find on their way. The ventilating pipe should therefore be located at the back end of the stage, ventilating the whole of the amphitheatre above the stage. Three or more pipes should therefore be arranged at suitable places, being provided with reliable suction devices. In order that the gases should have an issue at any height, the pipes should be fitted with suction openings at different heights, when the fire gases following the horizontal suction would instantaneously issue outside through the opening. Suitable safeguards, as for instance fireproof curtains, would in this case prove quite satisfactory.

Extinguishment of Petroleum Fires by Means of Milk.

Every day the journals bring to our notice new accidents due to the negligence or imprudence of those having petroleum lamps under their charge. Every well-kept kitchen is provided with a little stock of milk. While water only quickens the flame of petroleum or of gasoline, milk immediately extinguishes it and prevents all danger. This is a process which every mistress of a house ought to post in a prominent place in her kitchen.—Translated from Le Journal du Petrole.

THE JAPANESE SWORD EXERCISE.—I.

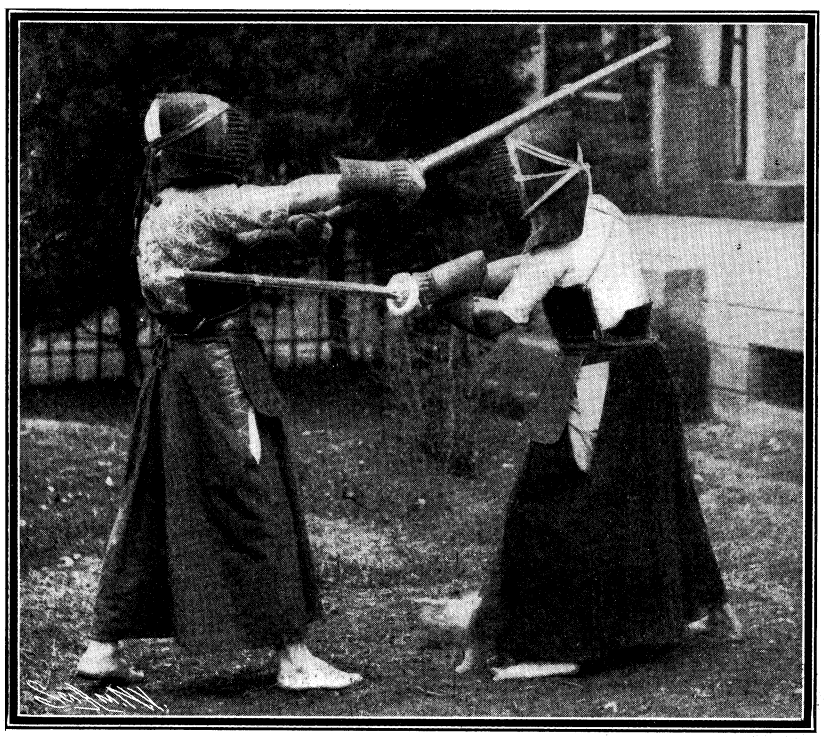
BY G. H. TILDEN.

Until the year 1603 A. D. there was no law existing in Japan with regard to the wearing of swords. Anyone might carry as many as he chose. During the Tokugawa *regime*, however, a law was promulgated which allowed only the nobles, the fighting men or *samurai*, the artists or painters, and the swordsmiths to carry swords. This law remained in force until 1877, when an edict was issued forbidding anyone to wear swords in public. This naturally created discontent among those whose privilege it was to carry them, whereupon the government proclaimed another edict, allowing anyone to wear as many swords as he pleased. This removed the cherished distinction attached to the wearer of a sword, and no one cared to do what was permitted to all. Although wearing swords has entirely ceased for twenty years in Japan, the old esteem and reverence for the weapon and its use still exists among the gentlemen of the country, and many of the nobility have at their houses regular establishments where fencing is practised. Fencing teachers are attached to the police stations, and every policeman is instructed in fencing with the two-handed sword, as well as in the practice of *jujutsu* or the "gentle art."

The Japanese sword is usually wielded with both hands, and cutting plays a much larger part in their sword play than the thrust and point. They also fence with two swords at once, the long two-handled weapon being held in the right hand, while the left uses the shorter and lighter blade. The accompanying photographs show the position of the fencers, and illustrate the blows and thrust employed. The fencer stands with his right foot forward and his sword held in both hands directly in front of him, its hilt at about the level of his waist, its point being at nearly the level of his opponent's eyes. The illustrations show some of the favorite blows. One favorite blow is a rapidly-delivered cut upon the outside of the right wrist and forearm. This serves to disable the right arm. When the fencer is using a sword in each hand, it is the left foot which is advanced. The long sword in the right hand is held upraised over the head, the point directed backward ready to deliver a cut, while the left hand holding the smaller sword is extended forward *en garde*. The user of two swords has a decided advantage over an adversary who wields but one.

My fencing teacher was originally a policeman, and about twenty years ago was stationed at the Yoshiwara in Tokyo. Everyone who visited this district was obliged to put aside his swords at the entrance, and was not allowed to enter with them. One night five men entered the district wearing their swords. Refusing to give them up, a policeman remonstrated with them, whereupon they killed him. Mr. Hemmi then came up, and engaging the five men, killed three of them, and put the others to flight. The reputation acquired by this feat of arms enabled Mr. Hemmi to set up as a teacher of fencing.

When handling and inspecting a sword, Japanese etiquette requires that the sheath should be held in the left hand, with edge of the blade uppermost. The blade having been gently withdrawn with the right hand, its various points are examined in the following order: 1, edge; 2, sides; 3, back; 4, point; 5, general shape and aspect. An old-fashioned custom was to put paper between the lips while examining a sword, in order to prevent the breath coming in contact with the blade, such contact being injurious to it. In removing the handle from the part of the blade upon which the maker's name is inscribed, the handle should be held in the left hand, the point of the blade directed upward, and the left wrist struck several sharp blows downward with the right hand. This done after removal of the pin which secures it, loosens the blade in the handle so that it may be removed. When the examination is finished, the blade is gently returned to its sheath with the right hand, and the sword is handed to someone else for his inspection. In handing a sword to anyone it should be held in the left hand and the back of the blade should be turned toward him, in order to signify that there is no ill will. Touching the blade or feeling its edge with the finger is never indulged in, being considered bad form.

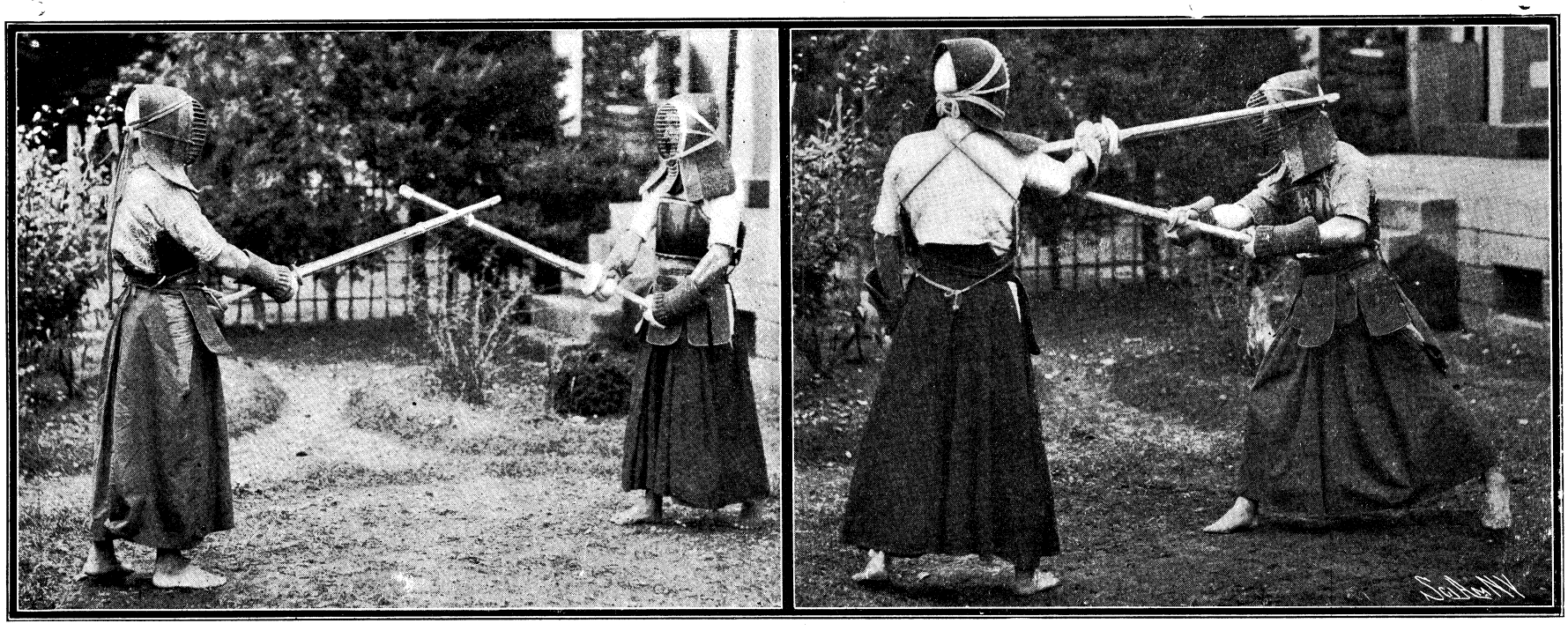


A Blow Upon the Top of the Head and One on the Side of the Body.

The swordsmiths of Japan are divided into two great classes, those of the "old school" and those of the "new school." All swordsmiths who lived before the beginning of the Tokugawa era, 1603 A. D., belong to the "old school;" while those who lived subsequently to this, are of the "new school." Among the swordsmiths of the old school there are four names which stand pre-eminent. These are, in order of their rank, Yoshimitsu, Masamune, Yoshihiro, and Munechika. Yoshimitsu, Masamune, and Yoshihiro all lived in the thirteenth century, while Munechika flourished in the tenth. Swords made by these men are now very rare. They are in the possession of families who would not part with them for any amount of money. There are in the list of the swordsmiths of the old school four named Yoshimitsu, four named Masamune, two Yoshihiro, and two Munechika. There are numerous forgeries also, and no one should go in for buying swords without having the advice of a trustworthy expert. The skill of some of these experts is little short of magical. I was told by a German gentleman living in Tokyo that he gave eleven sword blades to an expert for examination, and if my memory serves me, the expert correctly named the makers of ten out of the eleven blades without looking at the names engraved upon the hilts. Besides the four swordsmiths already named, there is another deserving of attention. This is Muramasa, who was a pupil of the great Masamune. He was widely known, and undoubtedly made swords which were excellent weapons, but his standing is very low in the rank of swordsmiths. He was a man of violent temper, and his swords acquired a bad reputation. It was supposed that once withdrawn from their sheath, they always shed blood before being returned. They were regarded as being particularly unlucky, so far as the Tokugawa family was concerned. The father and grandfather of Iyeyasu, the first shogun of the family, were both attacked by men carrying Muramasa swords. Iyeyasu therefore issued an edict forbidding anyone to carry them. It was in this way that they acquired their bad reputation. The relations between Muramasa and his master, the great Masamune, were amusing. Masamune did not have a very high opinion of Muramasa's work. One day Muramasa challenged him to a competitive trial of their respective swords. Masamune consented, and the sword blades were placed in a running stream of water, with their edges turned against the current. All the leaves, twigs, and rubbish which flowed down stream ran into Muramasa's sword and were severed, while they carefully avoided coming into contact with Masamune's blade. "Ah," said Masamune, "that demonstrates very well the difference between our swords; yours is bloodthirsty, and cuts everything which comes near it, while mine avoids doing unnecessary damage."

Muramasa left Masamune prematurely, went away into the country, set up a forge, and began to make swords on his own account. One night Masamune happened to arrive at the very village where Muramasa had established himself, and put up at the inn, entirely unaware of Muramasa's presence in the place. Muramasa's forge happened to be near this inn, and he worked in his forge during the night. Masamune heard him pounding away, and recognizing the work that was going on, he began to pound with his clenched fist upon the floor and walls of the room. In the morning, the landlord said to him, "Are you crazy? Why did you pound all night, and make such a racket?" Masamune replied, "I am not crazy, but by occupation I am a swordsmith, and hearing someone at work making a sword last night, I kept time with him by pounding with my fist, and I have come to the conclusion that he does not pound enough; he would make a better sword if he pounded more."

Masamune afterward met Muramasa, and said to him, "Ah, it was you that I heard last night; and let me tell you that you have got to pound more if you wish to make a really good sword. You ought to come back to me, and study seven more years before you can be called a good swordsmith." Muramasa consented to renew his study, but Masamune died before the seven years were up. I think that Masamune was regarded by my instructor as a better swordsmith than Yoshimitsu, who stood first on my list. While Masa-



Correct Position in Japanese Fencing.

Blow Upon the Side of the Head and Thrust at the Throat.

THE JAPANESE SWORD EXERCISE.

mune was second. One certainly heard more of Masamune than of any other of the old swordsmiths of Japan. He died at the age of eighty years at Kamakura, to which place he had come from Kyoto when seventy-one years of age.

My interest in the sword brought me into contact with a class of Japanese little seen by foreigners. I mean the genuine old-fashioned type; and from contact with these men, and knowledge acquired thereby, I think that one of the finest types of humanity was the medieval Japanese. They were possessed with a sense of honor, a devotion to duty regardless of consequences, unsurpassed elsewhere. Their point of view, of course, was different from ours, and may seem grotesque to us in many ways, but their sincerity and fidelity are not to be questioned.

THE CAHOKIA AND SURROUNDING MOUND GROUPS.*

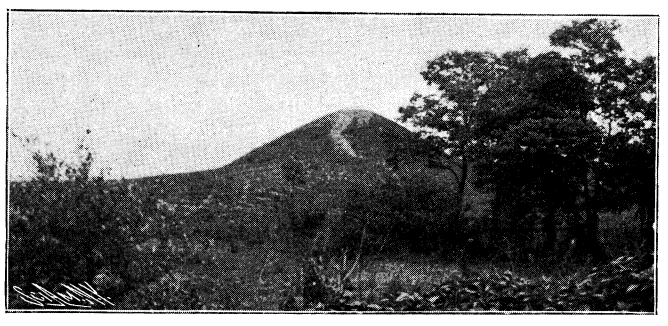
BY D. I. BUSHNELL, JR.

THE LARGEST MOUND IN UNITED STATES, WHICH COVERS MORE SPACE THAN ANY EGYPTIAN PYRAMID.

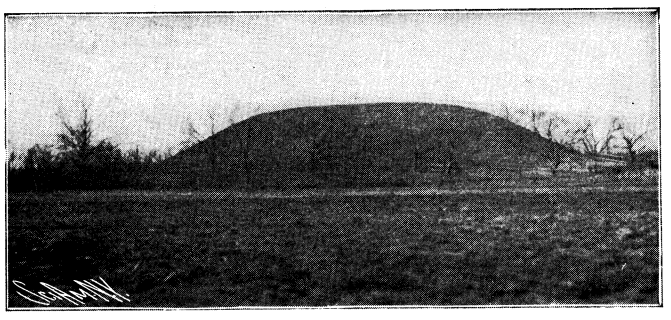
Below the mouth of the Missouri, for a distance of some 60 or 70 miles, the Mississippi is bordered on the east by the rich alluvial plain to which the name American Bottom is generally applied.

The plain rises gradually as it leaves the river, until it reaches the line of bluffs which forms its eastern boundary. In width it varies from 2 to 10 miles. At 38 deg. 40 min. N. L.—the location of the Cahokia group—the bluff line is 8 miles from the river. The country west of the Mississippi, unlike the lowland opposite, is high and rolling, and formerly, before the city of St. Louis occupied the site, a limestone cliff rose abruptly from the river.

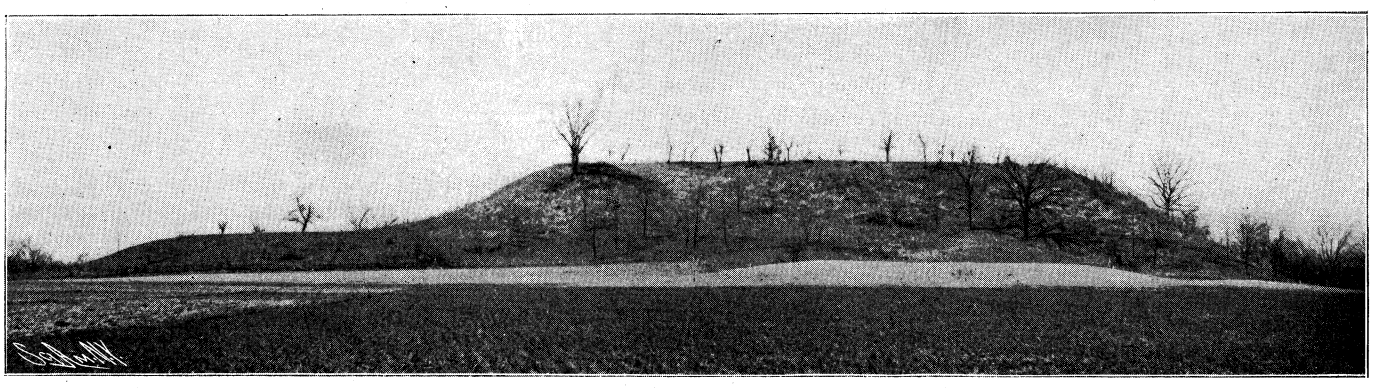
Near the center of the American Bottom is the largest artificial earth work in the United States, the great Cahokia Mound, which rises in four terraces to a height of 100 feet above the original surface. Its greatest dimension is from north to south, 1,080 feet; its width from east to west is 710 feet; while the area of the base is 14 acres.



One of the Lesser Mounds of the Cahokia Group.



Another Lesser Mound.



CAHOKIA MOUND: A TRUNCATED PYRAMID COVERING 14 ACRES, OR MORE THAN IS COVERED BY THE LARGEST EGYPTIAN PYRAMID.

Cahokia is surrounded by a group of more than seventy lesser mounds, any one of which, if not overshadowed by that great truncated pyramid, would itself be considered great.

The mounds of this group are of two classes—conical and truncated, and rectangular pyramidal. The larger mounds belong to the latter class, and were erected with their sides toward the cardinal points.

One and six-tenths miles west of Cahokia is a group of five mounds, the largest of which is one of the most perfect in the American Bottom. Extending in a southwesterly direction from this group is a chain of mounds which terminated at a group of fifteen smaller mounds, near the Mississippi, all of which have been destroyed. Across the river from this point a group of twenty-six mounds formerly existed on the summit of the bluff. These were destroyed many years ago, when the area was cleared and buildings erected, forming a part of St. Louis. A large isolated mound was located about 600 yards north of the main group. It was removed during the winter of 1869, and was found to contain a cavity or chamber in which were discovered many human remains and quantities of shell beads.

About 7½ miles northwest of Cahokia, and some 3 miles east of the Mississippi, is a group of eleven large mounds on the north side of Long Lake. These mounds, with the exception of one, have never been explored. Some years ago the largest was destroyed by the construction of railroad grades. At that time many interesting objects of bone, stone, and copper were discovered. The slope of the bluff eastward from the Cahokia group appears to have been one extensive burial ground. The great quantities of human bones which have been exposed by the plow and by the washing and wearing away of the surface prove that a great population, all traces of which are rapidly vanishing, once occupied that fertile region. Northeast of Cahokia, on the bluff, are two large conical mounds, perfect examples of that type. From the summit of these mounds a magnificent panoramic view of the American Bottom is obtainable. The great Cahokia group is clearly defined, surrounded by the homes and fields of the present owners of the land, while to the westward may be seen the waters of the Mississippi.

The name Cahokia applied to the mound group perpetuates the name of an Illinois tribe, which, together with the Tamoons, formerly lived in that part of the valley.

Few of the many mounds which formerly existed on either side of the river now remain in their original condition. Two entire groups have been destroyed to make room for buildings, while others, especially the Cahokia group, are being slowly but surely destroyed by the plow. Either the National government or the State of Illinois should act at once, and make the area occupied by the Great Cahokia and surrounding mounds a park, that these monuments of an unknown race may be preserved for future generations. The questions when, by whom, and for what purpose these mounds were erected cannot be answered.

THE FOREST PARK GROUPS.

There were formerly two groups of small mounds located near the center of the western half of Forest Park, in St. Louis, which area is now known as the World's Fair site.

When, during the autumn of 1901, it became necessary to grade that part of the park preparatory to the erection of certain buildings of the exposition, I was enabled to explore the mounds.

The two groups were distinctly separate, the smaller group of seven being located on the summit of the ridge or elevated ground to the south of the River des Peres, while the second group was in the lowland on the immediate bank of the stream. The average dimensions of the mounds of the smaller group were: diameter, 48 feet; elevation, 3 feet. In all were discovered pieces of chert, potsherds, and charcoal scattered over the original surface. The mounds of the lower group were somewhat higher and several feet less in diameter. They were likewise explored, but nothing indicating the handiwork of man was discovered.

The question has often been asked, For what purpose were these mounds, so numerous throughout the Mississippi Valley, erected? In the case of the seven mounds on the elevated ground, the finding of potsherds, pieces of chipped chert, and the indication of fire, all on what appeared to have been the original surface, would point strongly to their having been the remains or ruins of earth-covered lodges. The early explorers mention such lodges in different parts of the valley, and, until the last quarter century, large villages of such habitations were to be found in the upper Missouri Valley. But in the other mounds these indications did not occur. Clearly they were erected as they existed at the time of their destruction.

* Abstract of Paper being published by the Peabody Museum, Harvard University.

The Death of John S. King.

Mr. John S. King, for many years business manager of the Iron Age, the Metal Worker, and Carpentry and Building, died at his home on March 4, at the age of sixty-three. After having served with distinction during the entire civil war, Mr. King came to New York city, in 1868, and almost from the very beginning, identified himself with the business management of the various publications of the David Williams Company.

Brief Notes Concerning Patents.

A railroad tie of concrete and metal has been invented by G. M. Burbank, general manager of the Hecla Belt Line, Bay City, Mich. The tie consists of a cement form molded around a stiffening framework of twisted tiebar and an upwardly-bowed stiffening plate supported at either end by wooden blocks. The blocks extend above the surface of the tie, and form a resilient support for the rails. The wooden blocks are covered by broad plates with holes provided so that the tracks may be spiked to them; and as the plates comprise part of the tiebar referred to above, the whole forms a very solid construction. The under surface of the cement body is arched upward to decrease the size and weight. These ties have been in experimental service for some time under the tracks of the Hecla Belt Line, and have proven very serviceable.

On September 1 there died at Watertown, N. Y., Daniel Minthorn, who had passed his ninetieth year and who was well known as a geologist and inventor, and whose long career was an active and unique one. While a portion of his life was spent in New York city, the greater part of it was passed at Watertown or the vicinity, where he did most of his scientific work and developed a number of important ideas in inventions. It was here that he, with George Paddock, built a mill at Natural Dam, and inaugurated the process of grinding iron ore into paint, which was then done for the first time. The paint mill was changed into a talc mill, and again Daniel Minthorn was the pioneer of another new industry, for no one before him had ever ground talc. He was also one of the first to engage in the business of making daguerreotypes, the lens used by him having been made by himself from an old pair of spectacles. Like many a genius before him, his inventive faculties were developed at the expense of his business acumen; and while others made money from his inventions, he remained poor. His literary work was principally in the line of geology.

What is said to be the first commercial use for the X-rays has been discovered by a dentist of Cincinnati, Ohio, Dr. J. V. Cavans, who has found the rays available for the tanning of leather. Before making any announcement of the new process, the doctor says he has thoroughly satisfied himself of its success in every particular. Samples of the new leather have been tested by experts, and it is said they have universally been pronounced equal to that tanned in the old way in every respect. The old method of tanning leather has been in use from time immemorial, and the treatment has extended over a period of over five months. The greater part of this time is consumed in the tanning liquor, and the capacity of the tannery is often limited to the space to be had for the necessary vats. Because of the great amount of room demanded, the erection of a building for this purpose is necessarily expensive. With the new process, however, this is all changed, for no vats are required for storage of skins in soak, and a great number of skins may be treated in a small establishment. In following Dr. Cavans' method, the skins are soaked, as at present, in lime for the separation of the fibers and the removal of the hair. This usually requires about four days, after which the skins are soaked for about two hours in a solution which is part of the doctor's process, and then they are exposed to the X-rays for fifteen or twenty minutes, when they are said to be as completely tanned as a hide which has been four months in the vats. By using X-ray lamps of the most recent construction, it is said to be possible to treat a number of the skins at one time, thus bringing the cost of the application down to a minimum. This method reduces the process from one of four months to four days, and cuts down the cost by about 75 per cent. Furthermore, a tannery by the X-ray method can be erected for one-quarter the cost of one like those in use at present. Dr. Cavans' method dispenses with much of the skilled labor which is now required.

Legal Notes.

AN IMPORTANT QUESTION OF PATENT OFFICE PRACTICE.—In the case United States *ex rel.* Steinmetz v. Allen, Commissioner of Patents, published in 109 O. G. 549, the Supreme Court has rendered a decision of far-reaching effect on Patent Office practice. That part of the decision with which we have at present to deal is in substance, first, that an art or process and an apparatus for carrying it into effect may be of such interdependent nature as to be joined together in a single valid patent, and that rule 41 of the Patent Office Rules of Practice being repugnant to this principle is invalid; and second, that a repeated requirement by a primary examiner in the Patent Office, for the division of an application for patent into two or more separate applications, is a final action and is appealable to the Board of Examiners in Chief.

The question of the joinder of inventions and the division of applications has recently become a serious one for inventors and patent attorneys. It is well settled that two or more inventions may be made the subject of a single patent, provided they are dependent or correlated. Until a few years ago, the Patent Office followed this principle, a little more strictly than the courts, but nevertheless to such an extent as to allow a single patent to embrace two or more inventions if they were actually dependent upon each other. The practice in this respect, however, has been gradually contracted, until in its present form a great burden of expense and delay is placed upon the inventor by numerous requirements for division, and it may be seriously questioned whether the law gives authority for the actions of the Patent Office in many cases. Rule 41, referred to in the decision mentioned, requires among other things that processes and their machines be invariably presented in separate applications. Divisions in other subjects of invention are required with equal strictness. In a case recently under our observation, a patent was asked on an agricultural apparatus, and it was required by the Patent Office to divide the case into seven distinct applications. This condition of affairs in many cases makes the cost of protecting an invention prohibitive. Many inventors are poor, and have enough to bear without an extra expense in the Patent Office.

By the recent decision of the Supreme Court some relief may be afforded. From the fact that appeal may be taken to the Board of Examiners in Chief on questions of division, it follows that this question can be brought before the Court of Appeals of the District of Columbia; and if the Patent Office authorities continue to construe the rule of joinder of inventions so strictly, it is possible that their practice may be modified by the Court of Appeals. In the interest of the inventor and of the correctness of Patent Office practice, it would seem to be the duty of attorneys to push the question to a settled, and if possible more liberal, practice on the subject. It has been urged on behalf of the present system, that the exigencies of the classification of inventions demand this extreme division. With this view of the matter we cannot wholly agree. The classification is most important, but its integrity can be preserved by a proper system of cross references to the several classes, and consequently without resorting to a practice the authority for which is questionable, and which beyond doubt places too heavy an expense upon the inventor. If it be that Congress does not provide for a force sufficient to permit of properly classifying the subjects of invention without resorting to extreme requirements of division, then it is the plain duty of all friends of our great patent system to urge upon Congress the necessity of some action in the matter.

AN UNFAIR COMPETITION CASE DECIDED BY THE SUPREME COURT.—The French Republic as owner, and La Compagnie Fermière de l'Establissement Thermo de Vichy as lessee of the springs of Vichy, France, brought an action against the Saratoga Vichy Spring Company for the unlawful use of the word "Vichy," claimed by the plaintiffs as a commercial name or trade mark and appropriated for waters of defendant, which are drawn from a certain natural spring at Saratoga, N. Y. The defendants set up that for fifty years mineral waters had been sold throughout the world under the name "Vichy," and that such name has come to denote a certain type of water and does not stand for the water of any one spring; that Saratoga "Vichy" has never been sold as the Vichy of plaintiffs, but has been so labeled that all might know that it came from the springs of Saratoga. The bill was dismissed by the Circuit Court on the ground that the plaintiffs had no exclusive right to the word "Vichy," and that defendant had never been guilty of an attempt to palm off its waters as the imported article. On appeal the Court of Appeals reversed the decision of the Circuit Court and granted an injunction against the use of one particular label or "any other label in which the place of the origin of the water is not as plainly and prominently made known as the fact that it is named "Vichy." A writ of certorari was applied for and granted. The Supreme Court affirmed the decree of the Court of Appeals in an interesting opinion, of which the following is a digest:

"The title of the French Republic to the springs of Vichy, a commune of France, is clearly established. Known for their medicinal qualities since the time of the Roman Empire, and originally belonging to the feudal lord of Vichy, they were sold by him in 1444, together with the castle and its dependencies, to Pierre, Duke of Bourbon, in whose family they remained until 1531, when, for the treason of the Constable of Bourbon, they were confiscated by Francis I., and became the property of the crown, in whose possession they remained until 1790, when they were united to the public domain, and afterward passed to the French Republic and its successors, and were operated directly by the officers of the state until June, 1853, when they were leased for a fixed rental to a firm of which the Vichy company is the successor. The bottling and exportation of the waters was commenced before 1716, and in 1853 they began to be exported directly to this country, the shipments in 1893 amounting to about 300,000 bottles. For many years they have been bottled and sold all over the world.

"The rights of the defendant originated from a spring discovered in 1872 in the township of Saratoga Springs, New York, the waters of which, though differing from the waters of the Vichy spring both in ingredients and taste, have a certain resemblance to them which suggested the use of the word 'Vichy.' The water began to be bottled and sold in 1873 by the owners of the spring, and in 1876 became the property of the defendant which has since sold the water, using various bottles, circulars, and labels, containing more or less conspicuously displayed the word 'Vichy.'"

"As the waters of Vichy had been known for centuries under that name, the court thought there is reason for saying the plaintiffs had, in 1872, acquired an exclusive right to the use of the word "Vichy" as against every one whose waters were not drawn from the springs of Vichy, or at least, as observed by a French court, "from the same hydrographical region which may be called generally the basin of Vichy."

"True the name is geographical; but geographical names often acquire a secondary signification indicative not only of the place of manufacture or production, but of the name of the manufacturer or producer and the excellence of the thing manufactured or produced, which enables the owner to assert an exclusive right to such name as against every one not doing business within the same geographical limits; and even as against them, if the name be used fraudulently for the purpose of misleading buyers as to the actual origin of the thing produced, or of palming off the productions of one person as those of another.

"In a French case arising in this connection, and brought by the Vichy company against a rival company owning two springs in the same neighborhood, complaining that, by the composition of its name and the arrangement of its labels, as well as by the tenor of its different appeals to the public, the company owning these springs had created a damaging confusion between the two companies and their product, it was held that, while the rival company had a right to the use of the word 'Vichy,' it was bound to state the name of its springs, the place where they were located, as 'near Vichy,' in letters identical in height and thickness as those of the word Vichy in their advertisements and labels, and also the name of their springs in letters at least half their size; in other words, it was bound to adopt such precautions as would fully apprise the public that it was not purporting to sell the waters of the original Vichy company, though, being in the same basin, they were entitled to use that designation."

"A serious difficulty in the way of enforcing an exclusive right on the part of the plaintiffs to the use of the word Vichy was their apparent acquiescence in such use by others. For thirty years the defendant, the Saratoga Vichy Company, has been openly and notoriously bottling and selling its waters under the name of the "Saratoga Vichy" until its competition has become an extremely serious matter to the plaintiffs, whose importations began in 1853 with only 316 bottles, which by the year 1893 had increased to 298,500 bottles. The entire shipment of the Vichy company amounted in 1896 to nearly ten millions of bottles. Under such circumstances, and in view of the further facts that other waters were openly manufactured and sold in this country under the name of Vichy, and that a manufactured water was dealt out by the glass under that name in innumerable soda-water fountains throughout the country, it was impossible to suppose that the plaintiffs were not aware of these infringements upon their exclusive rights. "It argues much more than ordinary indifference and inattention to suppose that the large amount of this rival water could be advertised and sold all over the country without the knowledge of their agents, who would naturally be active in the protection of their own interests, if not the interests of their principals. In fact, they had allowed the name to become generic and indicative of the character of the water. With all these facts before them, and with the yearly increasing sales and competition of the defendant company, no move was made against them for twenty-five years, and until 1898, when this bill was filed. A clearer case of laches could hardly exist."

"The plaintiffs, then, were put in this dilemma: If the Republic was a necessary party, as it sued in its private and proprietary capacity, the defense of laches was available against it. Upon the other hand, if it was an unnecessary party, the defense of laches might certainly be set up against the Vichy company, its co-plaintiff."

The court did not think the position of the plaintiffs in this connection affected or strengthened by the eighth article of the treaty of June 11, 1887, with France and other nations, known as the Industrial Property Treaty (Comp. of Treaties, 684), which declares that "the commercial name shall be protected in all the countries of the Union without obligation of deposit, whether it forms part or not of a trade or commercial mark." [25 Stat. at L. at p. 1376.] That article was evidently designed merely to protect the citizens of other countries in their right to a trade-mark or commercial name, and their right to sue in the courts of this country, as if they were citizens of the United States. It could never have been intended to put them on a more favorable footing than our own citizens, or to exempt them from the ordinary defenses that might be made by the party prosecuted.

Conceding that the defense of laches would not be available in a case of actual fraud, or an attempt to foist upon the public the waters of the defendant as those of the original Vichy spring, the court found but little evidence of such purpose. The two waters not only differ in their ingredients and taste, but the French Vichy is a still, and the Saratoga Vichy, as well as the other American Vichies, an effervescing water. There was no attempt made whatever by the defendant to simulate the label of the plaintiffs upon the body of the bottle. "The word Vichy is never used by the defendant alone, but always in connection with Saratoga. The two labels not only differ wholly in their design and contents, but even in their language—that of the plaintiffs being wholly in French. Plaintiffs' label contains the word Vichy prominently displayed, with a picture of the thermal establishment where it is bottled and the name of the particular spring."

It was said by the Supreme Court in Delaware & H. Canal Co. v. Clark, 13 Wall. 322, 20 L. ed. 583, "In all cases where rights to the exclusive use of a trademark are invaded, it is invariably held that the essence of the wrong consists in the sale of the goods of one manufacturer or vendor as those of another; and that it is only when this false representation is directly or indirectly made that the party who appeals to a court of equity can have relief." Applying this doctrine to the case under consideration the court was clearly of opinion "that there is no such similarity in the labels as at present used, and that there is no such fraud shown in the conduct of the defendant, as would authorize us to say that plaintiffs are entitled to relief."

AN AMERICAN INVENTION BEFORE AN ENGLISH COURT.—There recently came up for adjudication in the Chancery Division of the High Court of Justice, the case of Fuller vs. Handy, which involved the validity of a patent granted to Ida May Fuller for "means or apparatus for effecting the simulation of flames of fire for spectacular purposes." The defendant, Emilie Diana Handy, alleged want of novelty in the plaintiff's invention by reason of publication of prior specifications; secondly, prior user; and thirdly, want of subject matter in view of the state of the art.

Put shortly, plaintiff's apparatus is of this nature. Under the stage is a platform, upon which are mounted fans having their axes converging toward one another; above that is an opening in the stage; below, are means for lighting through the hole in the stage. On the top is a box-shaped construction with a wire-work lid. To the wirework are fastened separate strips of transparent material in the form of flames. When the apparatus is in operation, the light is directed upwardly to the opening, and a draft is created by means of a fan below. The strips of material ascend, and give the appearance of flickering flames.

The defendant's appliance did not suffer essentially from plaintiff's invention. It seems that certain phases of the plaintiff's invention had long been known to stage managers. As to prior specifications the court did not find the whole combination of plaintiff's elements in any of them; but they did show, in the court's opinion, a great deal of common knowledge with reference to the art, and most of the elements comprising the plaintiff's invention. The use of fans is old; the use of strips illuminated by beams of light was old; the wirework or gridiron to which the strips were attached was old. To use the terms of American patent lawyers, the plaintiff had simply invented a new combination of old elements without producing any new result. The action failed and was dismissed.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

LIGHTNING-ARRESTER.—H. N. KEIFER, Topeka, Kan. In the present patent the invention has reference to new and improved lightning-arresters of the kind provided with a fuse, and capable of general use, but particularly adapted for service in connection with telephones, telegraphs, voltmeters, and the like.

Hardware and Tools.

SAW SWAGING AND FILING GAGE.—S. J. GALLOWAY, Hillsboro, Ore. This invention relates to a tool adapted especially for crosscut or drag saws; and it comprises devices for swaging or truing the drag-teeth and for gaging the filing or sharpening of the cutting-teeth, these devices being embodied in a single instrument, so that by means of this instrument the entire saw may be put in order.

TONGS OR CLAMP.—P. A. ORTH, Menno, S. D. Mr. Orth has in view in this invention the provision of a simple tool adapted to grasp a heated plowshare, so as to hold it in shape when immersing it in a bath for tempering the share. The tool affords protection to the edge of the share to prevent it from taking too hard a temper, and the tool is adjustable to plowshares of different sizes.

Heating and Lighting Apparatus.

LAMP.—C. G. HOLMBERG, Woonsocket, S. D. In this patent the invention relates to lamps, more particularly of the type used out of doors and subjected to all kinds of weather. It relates further to certain improvements upon the carbureters for hydrocarbon-vapor generators sometimes used in connection with such lamps. Gusts of cold wind or sheets of rain cannot affect the lamp. The globe and almost the entire outer parts may be covered with snow and ice and not materially impair the illuminating qualities.

LAMP.—R. P. HABEL, Sturgis, S. D. In this instance the invention has reference to improvements in gasoline-lamps, the object of the inventor being to provide a simple means for causing a constant and uniform pressure on the gasoline without the use of pumps, thus resulting in a steady light. Location of weights indicate when it is necessary to refill the reservoir, and to clean it, the cover and plunger may be easily removed.

RADIATOR.—G. M. AYLSWORTH, Collingwood, Ontario, Canada. The invention has reference more especially to the form of radiator shown and described in a former patent granted to Mr. Aylsworth. The principle object is to provide a structure of this kind which operates to promote the process of convection taking place within a room or other apartment in which the radiator may be located.

APPARATUS FOR FEEDING FINE FUEL AND AIR TO FURNACES.—A. E. CREIGH, Ronceverte, W. V. The primary object in this case is to distribute the fuel on the grate in such manner as to insure a better combustion of the fuel and the gases therefrom, and this is effected by a mechanism adapted to operate automatically. The fuel-dischargers proper may, however, be manipulated manually, and they are so arranged as to operate without obstructing access to the grate through the ordinary furnace-doors for raking the fire as practised in the case of boiler-furnaces.

Household Utilities.

PERMANENT MEMORANDUM FOR HOUSEHOLD USE.—A. R. MENSING, Chicago, Ill. The principal object the inventor has in view is to provide a simple and compact article of the type described which may be secured to a door or wall in a room where it may be easily and conveniently reached and will always be in plain view to remind the household of articles desired.

PICTURE-HANGER.—H. MINCK, Jersey City, N. J. One purpose of this inventor is to provide a picture-hanger constructed entirely of wire, and consisting mainly of two limbs connected by a hook or other form of suspension device, each of which limbs terminates at its free end in an open loop for attachment to a picture-frame.

Machines and Mechanical Devices.

METER FOR MEASURING WATER OR OTHER LIQUIDS.—O. C. PIPER, Horsens, Denmark. Water-meters built on the turbine and water-wheel principle generally suffer from the drawback that the meter registers differently by different pressures, and consequent different velocity of rotation. Another, that they are easily influenced by dirt and wear, and thereby become inaccurate, the least resistance against the revolving of the meter-wheel making the registration less. This device regulates the meter-wheel rotation so as to get rid of the above-named drawbacks.

GRIP-WHEEL.—H. F. ONG, Wendling, Ore. In this instance the invention has reference to improvements in cable-grip wheels for logging or traction engines, an object being the provision of a gripping mechanism operated by air or steam pressure and having means for automatically controlling the supply and exhaust of motive agent. The gripping takes place about two thirds the diameter of the wheel.

AUTOMATIC INDUCTION-VALVE FOR BOTTLE-FILLING MACHINES.—S. C. MILLER, Louisville, Ky. Mr. Miller's invention pertains to bottle-filling machines, and has for its object the provision of an induction-valve for the filling-tank thereof which will render the feeding of a supply of liquid to the tank automatic in operation. It is adapted for the filling of bottles of large or small dimensions.

BOTTLE-FILLING MACHINE.—S. C. MILLER, Louisville, Ky. The object of the present invention is to provide a bottle-filling machine having details of construction which especially adapt it for filling bottles with a semi-liquid material that does not flow freely—that is to say, condiments, such as mustard, catsup, and chile sauce, that require air pressure to enforce the passage from the tank through the filling-tubes and into bottles to be filled. Improvements in this class of apparatus are shown in two former patents granted to Mr. Miller.

ICE-MAKING MACHINE.—R. F. LEARNED, Natchez, Miss. One object the inventor has in view is to provide means in a freezing-can which will establish and maintain a circulation through the water in order to obviate the formation of a core in the center of a commercial cake of ice. A further object is to overcome clogging or closing of the air or gas supply pipe associated with the can, thereby insuring operation of the apparatus when maintaining it in service.

CLUTCH-PULLEY.—W. J. HILLIARD, Buffalo, N. Y. The present invention has reference to improvements in clutch-pulleys adapted for use on shafts and machinery; and one object the inventor has in view is the provision of a device which embodies in a single structure the parts necessary to drive or to be driven by a belt to make the belt member fast or loose with a shaft.

DECORTICATING-MACHINE.—A. D. ESTIENNE, 9 Rue Jean Martin, Marseilles, France. In this patent the invention relates to a machine for decorticating ramie and other plants, leaves, or textile materials, effecting a regular and complete decortication of all the leaves or stalks introduced into the apparatus and a ready separation of the hackled material. The specially arranged elastic pallets or paddles characterizing this machine can be applied to other forms of decorticating-machines.

CUPEL-MAKING MACHINE.—A. C. CALKINS, Los Angeles, Cal. Means are furnished by this invention for producing cupels used in separating precious metal, gold and silver, from lead by oxidizing the lead and forming it into litharge, which, with other impurities, are absorbed by the porous bone-ash, from which the cupel is made. The present invention more specifically relates to improvements in that type of machine disclosed in a former patent granted Mr. Calkins and provides means whereby the operation of making cupels will be more practical and economical and in which a more effective means for the cupel-body and ejecting the same from the mold is provided.

ORE-SEPARATOR.—H. J. BURROUGHS, Los Angeles, Cal. The mechanism separates precious metals from their ores. In carrying out the invention Mr. Burroughs has practically in view the production of a separator of the character specified which may be easily and readily assembled in position for use and which shall be simple in construction and capable of standing the strain and wear and tear to which it is subjected while in operation. Devices are provided for adjusting or raising and lowering the cylindrical water-tank of the separator relative to the mercury tank, and occupying little space.

WHEEL-LATHE.—J. R. CROWLEY, Savannah, Ga. This improvement relates to wheel-lathes, more definitely stated work-driving means for wheel-lathes. The special object is to simplify and improve the work-driving devices heretofore employed in connection with car-wheel-turning lathes. In the practice of this invention any type of center-drive lathe may be employed.

AUTOMATIC ADDING AND SUBTRACTING APPARATUS.—N. H. KODAMA, New York, N. Y. In this case the invention relates to that form of apparatus employing a series of wheels each carrying on its periphery a series of numerals, and the inventor provides special devices in connection with the wheels to insure the locking of the same at the proper times and to cause the operations to be perfected with accuracy and expedition.

STAVE-SHAPING MACHINE.—A. L. SHAW, Whitecastle, La. Mr. Shaw's invention refers to improvements in machines for shaping staves, by which he is able to prepare staves for tanks, vats, stills, and other regularly-tapered receptacles in a manner to give the desired longitudinal taper and the necessary bevel to the edges of the staves, both these operations being performed on the stave simultaneously and during its passage through the machine.

KNITTING-MACHINE.—I. W. LAMB, Perry, Mich. The invention pertains to machines of the Lamb type for two straight rows of needles arranged on opposite sides of the machines and between which rows of needles the work passes, as shown, for instance, in former Letters Patent granted to Mr. Lamb. The object of the inventor in the present case is to provide an improved machine more especially designed for producing mittens, sweaters and other garments having main and auxiliary parts.

Of Interest to Farmers.

COUPLING.—W. H. WALLACE, Whitefield, near Henry, Ill. The invention has reference to improvements in couplings particularly designed for use in connection with traction-engines for coupling the same to tenders, agricultural implements, threshing-machines, and other wheeled devices, Mr. Wallace's object being to furnish a coupling that may be readily attached to a traction-engine and that will be strong and durable. An engineer can couple his engine to a separator without assistance of those who are getting the latter ready for the road, thus saving much time and labor. Cushion springs are the only springs used and they avoid sudden jolting upon starting or stopping of an engine.

BINDER-COVER.—A. HERTJE, Tonkawa, Oklahoma Ter. The object of this improvement is to provide a structure affording a complete and effective cover for grain-binding machines. In many instances these machines are necessarily continually exposed to the elements and rapidly deteriorate by reason thereof. By means of this invention, however, they may be conveniently and effectively covered and protected from any deleterious exposure, as fully as though they were housed.

MECHANICAL MOVEMENT ADAPTED TO GRAIN-BINDERS.—W. C. DURYEA, Blawenburg, N. J. The intention in this instance is to provide novel means for driving a rotating knotter-shaft and a rocking needle-shaft without resorting to the use of a long train of gears and a complicated clutch mechanism usually employed for actuation of these parts. The subject-matter of this application constitutes a division of a prior application for Letters Patent filed by Mr. Duryea.

Pertaining to Vehicles.

SUPPORT FOR BUGGY-TOPS.—J. D'ALESSANDRO, Walnutgrove, Cal. The detachable support in this invention comprises a clamp attachable to what is commonly known as the prop support of the buggy, and it has spring supporting arms formed and arranged in a special manner with the effect that the weight of the top will be evenly distributed to prevent jolting and distortion of the top when the vehicle is traveling over rough or uneven ground.

BRAKE-LEVER ATTACHMENT.—R. W. COOKE, Condon, Ore. The purpose of this invention is to provide a brake-lever pawl which may be thrown into or out of action by momentum due to the movement of the brake-lever. This enables the lever to be operated from a distant point through the medium of a rope or other connection, so that by simply giving the lever a jerk the pawl is thrown into inactive position and the lever may then be released.

Railways and Their Accessories.

RAILWAY-SWITCH.—W. K. SMITH, Denver, Col. Primarily, the invention consists in switch mechanism for street-railways in which there is combined a lever pivotally secured in position between the railway-tracks connected to the switch-point and adapted to be operated by means secured to a tram, electric, cable, or subway car and under control or manipulation of the carman.

NUT-LOCK.—J. D. BRENT, Raymond, Miss. The improvement consists of new and simplified nut-locking means. A spring turn-button is turned down against the nut so that the latter will be securely locked against reversed turning on its bolt. The button will be held by a groove or recess thereon, engaging a projection or lug on an elongated plate. However, under ordinary circumstances a turn-button having a yielding engaging end so rendered by its transverse bent position will engage the nut with friction sufficient to hold it in locking position.

TRIPLE VALVE.—J. V. WELLS, Braddock, Pa. In this instance the invention relates to a triple valve applicable to the ordinary air-brake apparatus and by which means service, emergency, and high-speed brake applications may be made more rapidly and effectively than heretofore. Mr. Wells has also made another invention which relates to a triple valve applicable to the ordinary fluid-pressure brake apparatus operating the same as the usual triple valve and also capable of additional functions in that an application of the brakes may be made not only by a train-line reduction but by a train-line increase. The present invention has a certain reference to the organism disclosed in a prior patent granted Mr. Wells. The present valve is especially adapted to be used with the brake-valve shown in this inventor's copending application recently filed.

BRAKE-VALVE.—J. V. WELLS, Braddock, Pa. In this patent the invention relates to a brake-valve the principal object of which is to obtain by a relatively simple construction a greater control over the train-line pressure—that is to say, to be able to increase or diminish and to hold the pressure at any desired degree. It is designed especially for operating Mr. Wells' triple valve as disclosed in a prior patent, and in his copending application filed later.

Steam Engineering.

STEAM OR GAS ENGINE.—O. B. THORSON, Near Thor, Iowa. The aim of this improvement is to provide an engine arranged to permit the use of either steam or an explosive mixture as the motive agent, or steam at one end of the cylinder and an explosive mixture at the other end, at the same time allowing the engineer to reverse the engine whenever desired. The engine can be readily changed from a steam to an explosive engine, or vice versa.

ROTARY ENGINE.—F. P. UHRIG and B. F. UHRIG, St. Johns, Ore.—The intention in this improvement is to provide a rotary engine arranged to utilize the motive agent to the fullest advantage without danger of back pressure, and to permit convenient and quick reversing of the engine whenever it is desired to do so.

ROTARY ENGINE.—J. J. HORAN, New York, N. Y. In this patent the invention refers to improvements in rotary engines, an object being to provide an engine of this type that shall be simple in construction, having no parts liable to get out of order, comparatively inexpensive, and in which high speed and efficiency are secured with an economical use of motive agent.

ROTARY ENGINE.—A. F. FORD, Colfax, Wash. In the preferred embodiment of this invention Mr. Ford employs, briefly stated, a suitable casing or cylinder, in which is arranged a disk-like wheel carrying suitable buckets or pistons and peculiar shifting abutments, the cylinder being provided with opposite rotatable valves, ports adapted to feed and exhaust, and mechanism whereby the rotatable valves and shifting abutments may be worked.

CONDENSER.—T. DOUGLAS and G. L. CONROY, Baltic Wharf, Putney, London, England. This invention relates to a condenser of that class in which one pipe is run through a second pipe, one pipe carrying the gas or vapor to be condensed and the other pipe the condensing medium. Heretofore great difficulty has been experienced in connecting the outer to the inner pipe. Stuffing boxes and glands have been employed, and owing to the pressure of the high-tensioned gases being cooled or condensed it is extremely difficult to keep the connections tight. The present invention remedies this defect.

STEAM-TRAP.—C. A. DUNHAM, Marshalltown, Iowa. The object in this invention is to provide a trap adapted for low-pressure or vacuum work or in places where there is oil mixed with the condensation; to provide the trap with a by-pass adapted to be closed and opened at will; to provide means for holding the chambered diaphragm in place without interfering with its operation and to secure a steam-tight joint to the inclosing casing; to provide the trap with a strainer device, and to provide for construction movement of the diaphragm which is utilized in opening the valve. The invention relates to drain-valves and steam-traps disclosed in a prior application for Letters Patent filed by Mr. Dunham.

FEED-WATER HEATER.—W. A. MCKEE, Hinckley, N. Y. The invention relates to improvements in feed-water heaters for steam-boilers, an object being to provide a device of this character in which the water is rapidly heated by exhaust-steam and in which the water is purified of sediment, oil, and the like. It makes it possible to retain to a greater degree the heat units by having the cold water on the outside of the heater. The feed-water leaves the heater where the steam is the hottest.

STEAM-BOILER.—C. E. CHAPMAN, Fort Edward, N. Y. In this patent the invention refers to improvements in steam-boilers, an object being the provision of a boiler of comparatively small dimensions, but having a large heating area, so that steam may be quickly generated. The shell of the boiler is provided with manholes, so that the interior may be examined or to facilitate interior repairs.

Of General Interest.

HOLDER FOR FORMING ORNAMENTAL ARTICLES.—A. A. VON RENTHE-FINK, 14 Fürstengraben, Jena, Germany. This is an apparatus for the manufacture of ornamental articles from interlaced threads, strips or bands of materials of any kind by engagement thereof with needles or pins secured in a working or pattern plate, with means whereby the work-holding pins or needles may be moved with the work, so as to allow of its easy removal and of regulating the tension of the threads or bands during the working. The apparatus may be used for work made by hand or machinery.

HORSESHOE.—O. SCHRAMM, New York, N. Y. The shoe is formed with a removable and adjustable frog. The inventor has particularly in view the provision of a shoe with a resilient removable frog, the latter being designed to be held in position through the medium of a plurality of retaining bars or plates, these in turn being secured to the shoe by the removable calks with which the ends of the shoe are fitted. The shoe lessens shocks, etc., ordinarily borne by a horse.

COMBINED SIGN AND BIRD-HOUSE.—I. MASON, New York, N. Y. The purpose is to provide a device designed to be attached to a building or similar support, and to so construct as to not only display advertising matter to good advantage, but to provide a housing in which birds may build, and thus by their flights from their nests will serve as an agency to draw attention to the signs.

RACK.—C. D. LYON, St. Louis, Mo. The rack is designed especially for use in printing-offices to hold the printed sheets while they are

drying. The invention is applicable in various other arts, as will be apparent to skilled mechanics. The improvements reside in features of the construction by which a rack of large capacity compared to its size and adjustable to hold sheets of any standard dimensions is provided.

BOTTLE.—A. FRIEDMANN, Shreveport, La. In this case the object of the invention is the provision of a new and improved bottle of novel features and parts adapted to be readily destroyed when emptied of its contents, to prevent reuse of the bottle by any unauthorized and unscrupulous persons.

WINDOW-SCREEN.—W. A. CASSIDY, Fort Worth, Texas. The object of the invention in this instance is the provision of novel details of construction for a screen, that afford means for the escape of insects, prevent their free entrance, and also provide novel means for slidably connecting the screen with the casement of a window in a superior manner.

MEANS FOR REMOVING SAND-BARS.—E. H. ALLMAN, Mobile, Ala. The apparatus is adapted for use in removing sand-bars beneath the water where there is a sufficient current to wash away the sand loosened by the apparatus. A series of plows are employed for furrowing the sand, the same attached to beams which are pendent from and adjustable vertically in a framework secured to a scow or other floats and projecting beyond the bow and stern. The framework is peculiarly constructed and arranged, and the plow-standards are adjusted and supported by special mechanism. It is also adapted for use in finding and removing torpedo cables or conductors.

DIE FOR PRODUCING ARTICLES FROM PLASTIC MATERIALS.—L. STEINBERGER, New York, N. Y. The object in this improvement is to produce by molding perforated insulating-strips having both vertical and slanting holes in an efficient manner and to obtain a positive uniformity in location of holes and their given diameters. Vertical holes are adapted for receiving fastening devices, slanting holes are intended for receiving wires or cables. The insulating-strip is attached to the cable-box in a manner to prevent rain or moisture entering the box.

HANGER.—G. NISSENSON, New York, N. Y. This hanger is intended for supporting pipes, electric wires, electric lamps, and the like from ceilings and other supports in buildings. The object of the invention is to provide a hanger very ornamental in appearance, and arranged for convenient attachment to the supporting structure such as iron and wooden floor-beams. The device may be used as a junction-box for electric connections.

DENTAL-PLATE MOLD.—O. E. DRISCOLL, Charlottesville, Va. In the present instance the invention is in the nature of a mold to be used in molding plates for artificial teeth after the impression has been taken. It consists of a palate portion made in two sections of metal fitting together, the inner section of which is made one of an interchangeable series, each having an arch of different height to be selected and used according to the shape of the particular impression.

CONVEYER.—J. G. DELANEY, New York, N. Y. The invention has reference to an improvement in hoisting and conveying devices. The device is applied to a conveyer in which a cable is used as the trackway, although the invention may be applied to any form of hoisting and conveying apparatus in which a carriage is employed running upon a trackway, whether that way be a cable or other flexible member or is composed of rigid bars or beams.

HOISTING AND CONVEYING DEVICE.—J. G. DELANEY, New York, N. Y. This improvement is applied to a cableway, although it may be employed as well in connection with any form of tramway. The draft of the hoisting-chain is always kept in a direct line beneath the trackway rope and there is no side strain tending to pull the chain off the wheel. Draft is always central, the power constant. A chain of sufficient length brings in loads from great distances on either side of the line of cableway, thus increasing its efficiency. The guide rollers each side of the chain are not needed after the chain becomes strained, as then the carriage swings so that the draft is central.

SPOOL HOLDER AND CASE.—M. MAAS and F. RICAUD, Baton Rouge, La. The purpose of the invention is the provision of a compact case for receiving, holding, and protecting spools or reels of ribbon, tape, or like material, the body of the case being revoluble upon its support, and also to provide a perfect system for automatically measuring the material as it is drawn out from the case through suitable openings therein.

OBSERVATION-WHEEL.—D. W. BLAIR, Perth Amboy, N. J. Mr. Blair's invention relates to observation-wheels, his more particular object being to produce such a type of wheel as will afford amusement and recreation and will be distinctly adapted for public use. Passengers going forward only a few yards will have the sensation of traversing a great distance, the device thus acting to some extent as an illusion apparatus.

HORN.—W. GEBERT, Trenton, N. J. The object in this instance is to provide a reed horn or trumpet the tone of which may be regulated at will. It has been sought to attain this by providing a reed-adjusting member attached to the reed and projecting beyond the reed-box, so that the member may be grasped and the reed manipulated according to the tone desired. Mr. Gebert provides a horn in which this regulation of the reed may be effected by the tongue and lips whereby a much more delicate action is attained and a neat, compact instrument provided.

DESK.—O. C. DORNEY, Allentown, Pa. Mr. Dorney's invention pertains to improvements in desks designed to be used in school-rooms, libraries or the like; and the object is to provide a desk of simple construction that may be readily and quickly adjusted as to height and having all conveniences for a person in reading, writing or study.

KNOCKDOWN CHAIR.—E. BEHN, New York, N. Y. In this patent the improvement refers to chairs or seats that have detachable legs, and has for its object to provide novel details of construction for a chair which affords means for the quick and convenient detachment of the legs from the seat of the chair and for securing them thereto in a reliable manner when the chair is to be set up for use.

Designs.

DESIGN FOR HAMMOCK-CLOTH.—D. W. SHOYER, New York, N. Y. The design in this case is intended to produce an attractive effect by running bands mainly of checker-board pattern across parallel cords. The plain and other bands are irregularly spaced and present a clear ornamental field.

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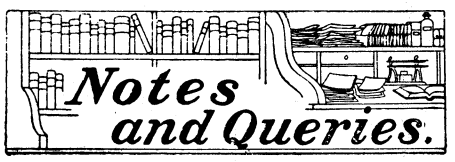

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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(9326) J. F. S. says: I have been called on to investigate a peculiar case which has puzzled me, and I would ask your advice on the same. The case in question is a house which seems to be a veritable frictional machine. By walking on the carpet a spark can be produced by bringing the finger near any metal substance, whether grounded or not, such as a brass tack in furniture, picture frames, etc. If this condition existed to a small extent, nothing would be said, but it is to such an extent as to be very objectionable. The house is heated by a hot-air furnace, and everything about the house is very dry. I have suggested keeping water pan in furnace constantly filled with water, as I believe that the moisture produced will tend to allow the charge to neutralize itself. Two persons coming in contact with each other produce a spark. Can you suggest a remedy for this, or something which will make it less pronounced? If so, you will oblige a constant reader of SCIENTIFIC AMERICAN. A. It is most likely that moistening the air of the house which you describe will free its occupants from the trouble with static electricity. We have no other suggestion to make. Moisture is relied upon to cure this condition, which is universal at this season of the year.

(9327) H. G. A. asks. 1. In a recent issue you explained how to demagnetize a watch with direct current. Will you explain fully how this may be done with alternating current? A. A watch may be demagnetized by an alternating current by sending the current through an electromagnet, and holding the watch near the wire core of the magnet. Now turn the watch over and over as you slowly remove it from the field of the magnet, till it is quite out of the sphere of influence. 2. In a direct-current electric plant I understand the current flows continually in the same direction through the circuit. Which wire carries the outgoing current, and how may this be known at the dynamo? A. The current is taken to flow out from the positive pole of a direct-current dynamo and return to the negative pole. The positive pole may be found by a voltmeter or by a pole detector. These can be bought of dealers in electrical supplies. 3. If the armature of an alternator runs 1,500 R. P. M. and is surrounded by ten field magnets, would the alternations be 15,000 per minute, or would the current only change five times per revolution, as the magnets must be in pairs? A. At 1,500 turns per minute with ten field magnets, an alternator will have 15,000 alternations per minute, and half as many cycles per minute.

(9328) C. A. R. asks: What power or voltage, if any, has a gravity battery, the jar of which is 6 inches x 8 inches and has a 3-pound zinc? A. A gravity cell in good condition will have from 1.07 to 1.10 volts. The size of the jar and the plates has no effect on the voltage, which depends only upon the materials used.

(9329) F. A. B. writes: We are much troubled with water hammer in the hot-water pipes. It can sometimes be stopped by turning on the hot water and then turning it off very slowly. I found a loose gland on one of the faucets the other day. When I tightened this gland, the water hammer became very faint but much more rapid. What can I do to remedy this matter? A. The hammer or rattle in house pipes may be due to the generation of steam in the water back, which in passing into the boiler condenses suddenly, producing the hammer action. The noise from open faucets is caused by looseness of the valve in the faucet. The remedy for the first is less fire or the use of more hot water or its waste by drawing off. For the latter use solid plug faucets or valves without loose disks. 2. What size fuse wire should be used in connection with a 5-ampere 100 to 110-volt wattmeter? A. Fuse wire if of lead should be 2 inches long, No. 16 wire gage or 1-20 inch diameter. 3. Why do our hot-water pipes freeze before the cold water pipes when they are both in the same place and subject to the same cold? A. The water in the hot-water pipe is free of air, which is discharged by heating, and the pure water freezes quicker than the cold or aerated water.

(9330) W. J. H. asks: Can you give me the names of the ingredients of a light which is confined in a bottle, as used in the powder magazines in France? Not being exposed to the air, it lessens the danger of explosion. When dim it is replenished by a supply of fresh air by removing cork of bottle. A. The light to which you refer is probably produced by phosphureted oil. A piece of dry phosphorus about the size of a pea is placed in a test tube, and a little pure olive oil poured upon it. The tube is held in a water bath till the oil is heated above the melting point of the phosphorus. Now shake the tube till the oil will take up more phosphorus. After the oil is cooled, put it into a glass-stoppered bottle. When the small quantity of oil in the bottle is shaken about so as to coat the sides of the bottle, a good amount of light is given, and when this becomes dim it may be made luminous again by removing the stopper and admitting fresh air. Use care in handling phosphorus.

NEW BOOKS, ETC.

TABLES GIVING THE LENGTHS OF BARS FOR SKYLIGHTS AND RAFTERS FOR ROOFS. By H. Collier Smith. New York: David Williams Company. 1903. 18mo. Pp. 84. Price $2.

The author of these tables is a practical sheet-metal worker of many years' experience in the manufacture of skylights. In order to save time during the day, he devoted his leisure hours in the evenings, for several years, to computing tables, from which the length of bars for any ordinary pitch of skylight could be copied, and thus avoid the loss of time and chance of error involved in working out the length of bars for each separate skylight during the rush and stress of working hours. A labor-saving book of this nature is invaluable to those in the business.

ELECTRICAL ENGINEERING. An Elementary Textbook. By E. Rosenberg. Translated by W. W. Haldane Gee, B.Sc., and Carl Kinzbrunner. New York: John Wiley & Sons. 1903. 8vo. Pp. 267. Price $1.50.

The present book will be distinctly helpful to less advanced students of electrical engineering in English-speaking countries. It is the work of an electrical engineer, and is written from an engineering standpoint. The explanation of principles is particularly clear. In polyphase work the author has been specially careful to make his explanation easy to follow. Particular attention has been given to alternating currents. The diagrams are very clear, and this new book will certainly prove helpful to the young electrical engineer.

INTERNATIONAL EXCHANGE. Its Terms, Parts, Operations, and Scope. By Anthony W. Margraff. Chicago: Fergus Printing Company. 1903. 8vo. Pp. 299.

The exporter and importer can, with the present textbook and the daily journals, quoting the rates for interest in the financial centers of the world, readily determine the approximate value of any foreign bill of exchange. The examples which are given are admirable, and the book can be safely recommended to all those who have financial transactions with banks, firms, or individuals in foreign countries.

LEHRBUCH DER BAUMATERIALIENKUNDE ZUM GEBRAUCHE AN TECHNISCHEN HOCHSCHULEN UND ZUM SELBTSTUDIUM. Von Max Foerster. Heft 1. Die Natürlichen Gesteine. Mit Einer Tafel. Leipzig: Verlag von Wilhelm Engelmann. 1903. 8vo. Price $2.

The book which lies before us discusses structural materials, and is intended for civil engineers and architects. The first volume issued is devoted to a treatment of natural stones. The author has laid particular stress upon the adoption of a scientific nomenclature, as well as upon the physical and chemical constituency of the various stones. Prof. Foerster holds, and holds rightly, that only by this means is it possible to obtain anything like a definite knowledge of the composition, structure, and durability of various stones as structural materials. A chapter of the book is devoted to testing methods and processes of determining the resistance of structural materials. The various applications of structural materials are also discussed in a coherent manner. Considered as a whole, the work bears the mark of the same accuracy and thoroughness that characterized Foerster's Handbook of Engineering, which we had the pleasure of reviewing some time ago.

THE PHOTOGRAM. Vol. X. London: Dawbarn & Ward, Ltd. 1903. 8vo. Pp. 380.

The Photogram is always a most welcome visitor. The present volume, which consists of the numbers for 1903, is filled with useful information. The artistic presentation of good examples of up-to-date photography will be appreciated. The photographs chosen for reproduction are particularly well selected.

A MANUAL OF MECHANICAL DRAWING. By Philip D. Johnston. New York: David Williams Company. 1903. Oblong 8vo. 69 plates. Price $2.

Of the making of books on mechanical draw-

ing there seems to be no end, but the present volume is a most admirable treatise. It will be specially appreciated by those who have to learn mechanical drawing at home. The author's selection of typical examples is most excellent. It is a thoroughly safe book.

We have received from the American School of Correspondence at Armour Institute of Technology, Chicago, Ill., the first number of a new periodical issued by the school, called the Technical World. The magazine promises to become a valuable addition to technical magazine literature. This first number contains an excellent article by Prof. R. A. Millikan, on Radium, and general discussions of such subjects as wireless telegraphy, current science and industry, new things in engineering, and great technical schools. A consulting department tells instructive things about the control of electric lights, comparative weight of motors, transferring heat to boilers, and the like.

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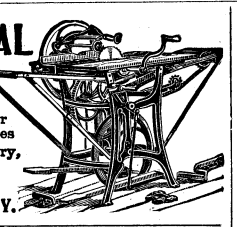

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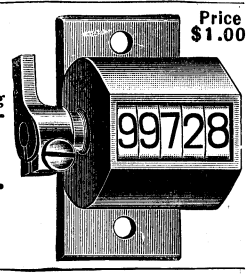

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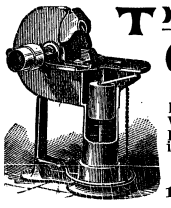

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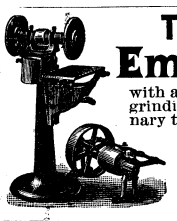

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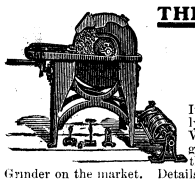

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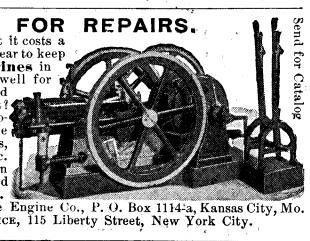

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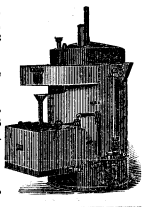

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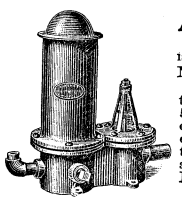

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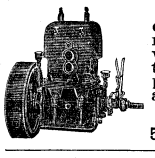

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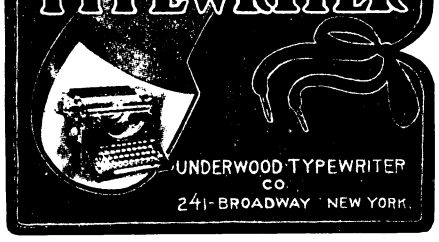

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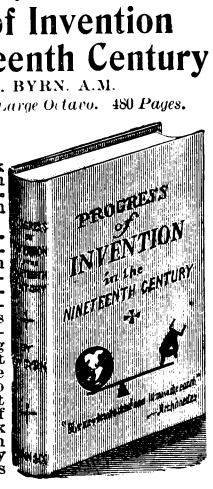

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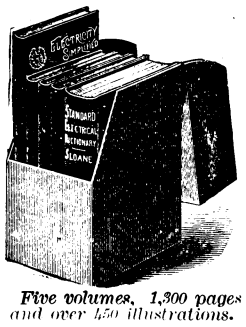

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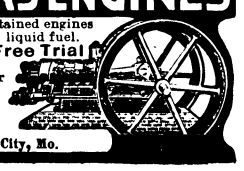

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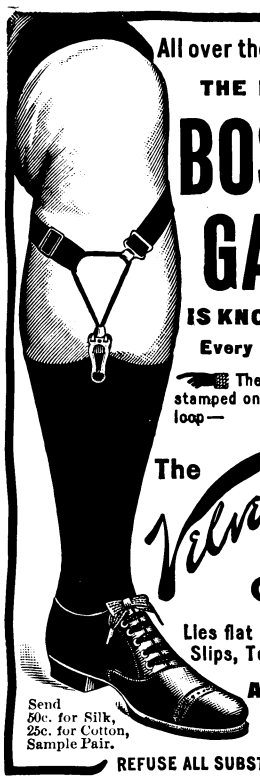

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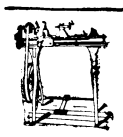

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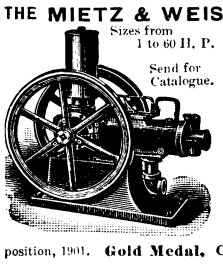

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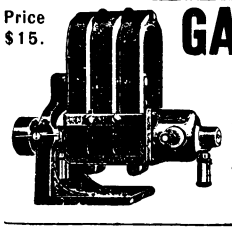

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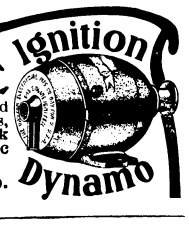

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are no experiment, as they are in successful operation in all parts of the world.

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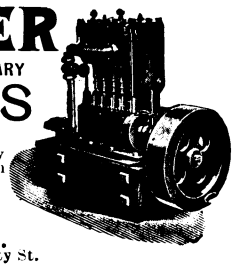

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Shaving with greater comfort, luxury, convenience.

Saving in time, temper and money. A single stick affords over 300 shaves. No cup required. Only the shaving stick and brush.

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for showing the marvelous properties of radium. With particle of Radium, postpaid, **$9.00.**

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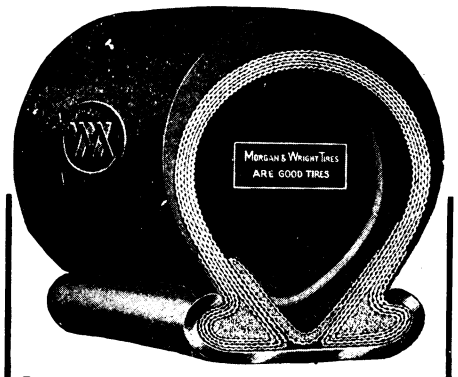

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Nothing has been omitted, nothing overdone in making it a tire that can be **depended upon.**
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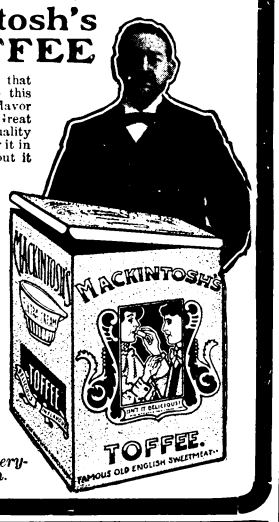
Let me tell you if you want to get all the sweets of life you cannot afford to ignore or overlook

Mackintosh's EXTRA CREAM TOFFEE



an old English candy that I am introducing into this country. Its exquisite flavor has made it popular in Great Britain and the same quality is creating a demand for it in this country. I have put it on the American market because I know American people like good things. Ask your dealer to supply you with

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Try him first. You can, however, buy a handsome family tin, weighing four lbs., for $1.60 by mail. Large sample package sent for 10c. in stamps.

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NEW YORK CENTRAL'S

"Four-Track Series" No. 13 gives the population of all cities in the United States of more than 8,000 inhabitants according to the census of 1900, and a comparative table showing the population in 1890. It also contains two maps in colors.

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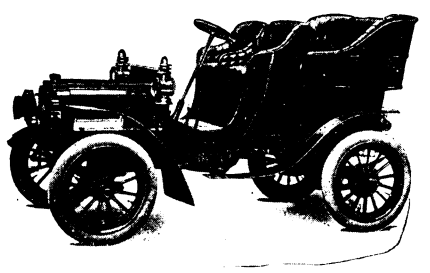

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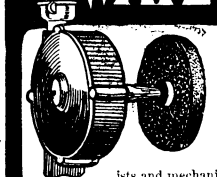

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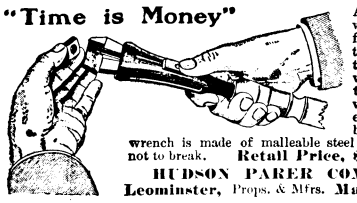
"Time is Money"



And this wrench will do the work for you in less than half the time of other wrenches, and the harder the work, the tighter it holds. The body of this wrench is made of malleable steel and warranted not to break. **Retail Price, $1.00 Each.**

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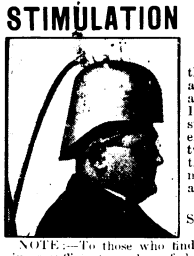
Means New Life to the Scalp.



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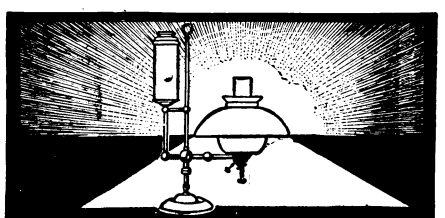

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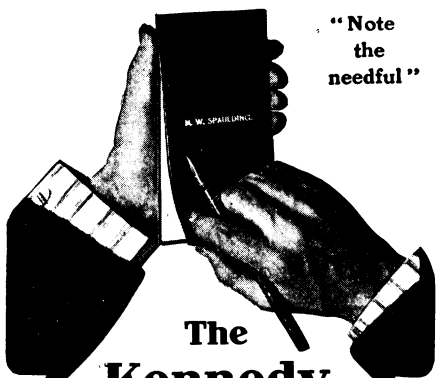

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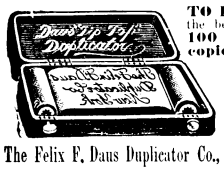

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LOOK FOR THIS MARK.
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Well strainer, drive, W. H. Broome 753,846
Wheat or other grain shredder, J. H. Stevenson 753,931
Wheel. See Traction wheel.
Wheel fender, M. E. de los Monteros..... 754,331
Wheels, manufacturing, T. D. Harris..... 754,304
Whistle, F. L. Johnson 754,314
Window frame and sash, A. K. Lovell..... 753,893
Wire reeling apparatus, C. L. Packer..... 754,006
Wire reeling machine, T. Nighbert 754,336
Wire rod cleaning machine, J. S. Ferguson. 754,209
Wire weaving machine coiler, W. Bills 754,118
Wool burring and picking machine, G. Prouvot 754,236
Wrench, Eliel & La Bart 753,862
Wrench, G. E. Fox 753,869
Wrench, C. H. W. Relyea 753,915
Wrench, J. M. Reams 754,012
Wrench, Hawkins & Cary 754,063
Wrench, W. R. Johnson 754,069
Wrench, J. R. Harrison 754,137
Writing machine carriage spacing attachment, L. Maybaum 754,155
Zinc, obtaining, E. H. Hopkins..... 754,141
Zinc, portable machine capable of bending or molding sheet, A. H. Bif 753,844

DESIGNS.

Braid, H. P. von Nostitz 36,847
Card, playing, S. N. Barker 36,844, 36,845
Cup or similar article, C. J. Ahrenfeldt.... 36,837
Glass vessel, cut, W. C. Anderson 36,836
Jewel casket or similar article, E. L. Brainard 36,833
Picture frame mat, C. A. Hartman..... 36,846
Plate or similar article, C. J. Ahrenfeldt, 36,839 to 36,842
Plate, souvenir, M. Tonnemann 36,843
Spoons, forks, or similar articles, handle for, J. Clulee 36,834
Spoons or similar articles, handle for, S. J. Large 36,835
Teapot or similar article, C. J. Ahrenfeldt. 36,838

TRADE MARKS.

Almanacs, Gruber Almanack Co.....42,192, 42,193
Bath room and lavatory receptacles, certain named, J. P. Eustis Manufacturing Co.. 42,224
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Bottle stoppers, A. Blumer 42,223
Clothing, certain named ready made, F. B. Q. Clothing Co. 42,202
Coffee, L. H. Costikyan 42,206
Cotton piece goods, G. Willis & Co..... 42,195
Darning and crochet cotton, Clark Mile-End Spool Cotton Co. 42,196
Flour, wheat, Kansas Milling & Export Co., 42,208, 42,209
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Gloves and mittens, Boss Mfg. Co...42,198 to 42,201
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Medical compound for correction of foot troubles, Slack & Griggs 42,216
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Medicines, catarrh and cough, L. Bodie.... 42,215
Metal and stove polish, H. Pape..... 42,210
Optical goods, certain named, Yve. E. Colomont, Valette et Cie 42,219
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Paper, bond, W. E. Wroe & Company..... 42,194
Perfumery extracts and essences and toilet waters, A. J. Hilbert & Co..... 42,215
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Rubber nipples, Davidson Rubber Co. 42,222
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Soap, scouring, Standard Soap Co. 42,211
Specific for female complaints, liquid, G. Mortimer 42,217
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Thread, cotton, Clark Mile-End Spool Cotton Co. 42,197
Washing fluid, Washaway Manufacturing Co. 42,212

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"Do-No," for medicine, L. G. Denton..... 10,809
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"Exotic Balm," for liniment, J. A. Wood.. 10,810
"Factory Bunch," for cigars, Schmidt & Co. 10,805
"Gold Bond, Knox, Dust, Fill, Medal, Plate Shoes," for shoes, J. B. Hunter..... 10,799
"Hot Cake," for cigars, Schmidt & Co..... 10,807
"Ice Cups," for biscuit cups for holding ice cream, I. Marchiony 10,817
"Jackfull," for cigars, Schmidt & Co..... 10,804
"Luebert's Nox 'Em, Nox 'Em Quick," for insecticides, A. G. Luebert 10,814
"Non Rustin," for sheet metal ware, Rochester Nonrust Tinware Co..... 10,818
"Prosperity," for cigars, Schmidt & Co.... 10,806
"Salvator Salve," for salve, G. Flanagan.. 10,811
"Simon Pure," for baking powder, Gilliland Baking Powder Co..... 10,816
"Slater's Lemon Lotion," for toilet preparation, Slater Manufacturing Co..... 10,813
"Toke Point Perfecto," for cigars, C. H. Sonntag 10,803
"Violet Emollient Skin Tonic and Massage Cream," for emollient preparation, C. Friedgen 10,812
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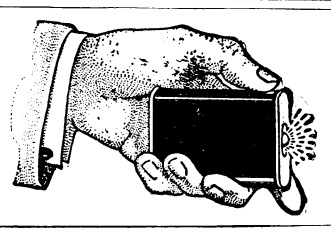

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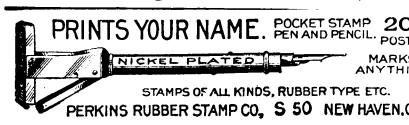
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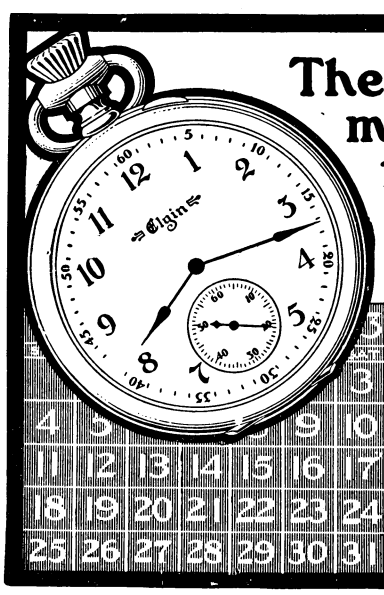

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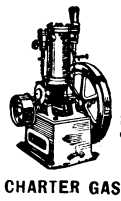

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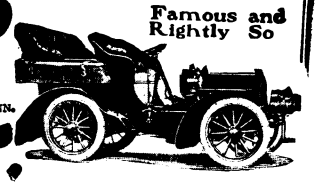

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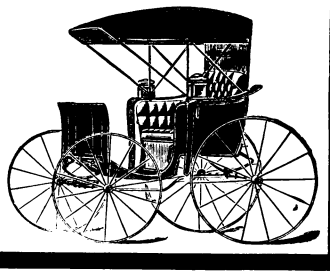

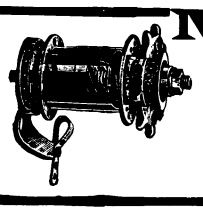

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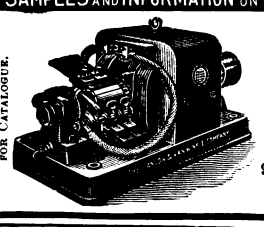

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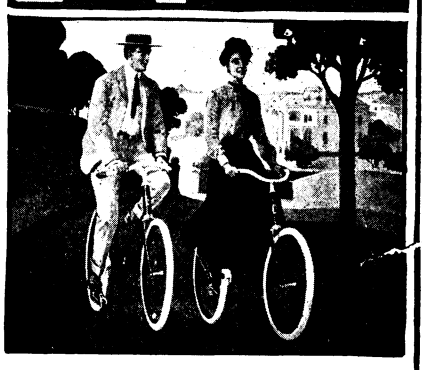

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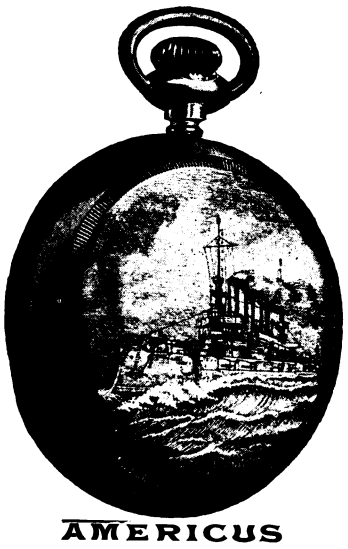

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